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THE IRON TRADE REVIEW

VOLUME XXXIII. CLEVELAND, O. JANUARY 18, 1900. CHICAGO, ILL. NUMBER 3

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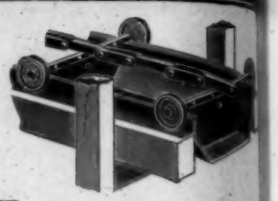

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THE IRON TRADE REVIEW

VOLUME XXXIII. CLEVELAND, O. JANUARY 18, 1900. CHICAGO, ILL. NUMBER 3

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

Just how long a wait the pig iron trade can stand and still maintain prices on the level of to-day, is a question on which opinions are of little value. The important fact is that there has been no weakening from the December level and that production does not grow according to theoretical calculations, blast furnaces having constant reminders of the thinness of the lines that connect them with raw material supplies. Meantime there are signs of greater firmness in some finished materials, particularly plates and sheets, which for some time have been notably weak. The equilibrium between production and consumption of pig iron, which was reached in December had changed to an insignificant gain in stocks on Jan. 1, the report of the Western Pig Iron Association showing 13,000 tons more on that date than on Dec. 1. Foundry buyers, who will need considerably more iron for the first half of the year are waiting, believing that lower prices are due. But from the standpoint of the furnacemen the conditions do not suggest concessions. The situation in Bessemer pig iron is indicated by the fact that the producers were unable to entertain an inquiry the past week for a round lot, delivery in the first half of the year, and the further fact that a Shenago valley steel plant, originally shut down for repairs, continues idle while the output of the furnaces heretofore supplying it goes to a Mahoning valley steel works that the latter may be kept in full operation. Coke supply is still insufficient in the Central West, and occasional bankings of furnaces are still reported, raising a question as to the adequacy of present arrangements to take care of the additional furnaces which are soon to go in. The situation as to steel is unchanged. Contracts must soon be made, and while buyers seem to consider $33 a fair price, there is less prospect than appeared a month ago of any modification of sellers' quotations, which are $35 for billets and $36 for sheet bars. The effect of the rod mill strike upon the steel market would be to increase the billet supply, if there were a general interruption of operations. The outcome is uncertain, but as yet the strike has not assumed important proportions, and there is a lack of unanimity among the men. An illustration is given, however, of the possibilities of labor trouble that hang over the present exceptionally prosperous situation in the iron trade. That labor is well paid does not insure against an outbreak that may upset all calculations. In several departments of the trade, and in consuming lines as well, the labor side involves some contingencies that may become actual conditions a little later. From the standpoint of finished materials, the general outlook has improved in the week. Plate and sheet mills are firmer, and in structural material the indications point to an advance, though action may not be taken at once. The attitude of producers indicates an expectation thatthe renewed plans for a sheet mill consolidation will be carried out successfully. Two important producers may not enter the new company, but this will not prevent its formation. The Chicago district has done a considerable business in rails the past week, 25,000 tons being closed, a part of it for export. A 3,000-ton structural contract from Chicago was placed in Pittsburg. In bars there is a firm situation in the Central West, both in iron and steel.

PITTSBURG.

OFFICE OF *The Iron Trade Review*
705 PUBLICATION BUILDING, Jan. 17.

There is a slightly better feeling in the iron and steel market than in the past week or two. Inquiry is growing heavier, and prices show an advancing rather than a declining tendency. Those best posted assert that there are good evidences of a decided buying movement in the near future. Consumption is keeping up at a good rate and is increasing. Many buyers still profess to see nothing to be gained by coming into the market at once, but it is the fact that a great many consumers have not yet contracted for their first quarter requirements, and this will bring them into the market very shortly.

There is very little to note in the way of changes in prices. In a number of lines they are a trifle firmer, but as yet are not quotably higher. Pig iron is very firm, and gray forge is in especially good demand, with little to be had. Steel is rather quiet. In both plates and sheets there is greater firmness owing to the withdrawal in each line of some low sellers. Prices on steel bars are well maintained.

PIG IRON.—There is an inquiry for a considerable quantity of Bessemer iron for the first half. A meeting of the executive committee of the associated valley furnaces was held in Cleveland on Saturday last, but it was not found that the iron could be furnished as desired. Prices on Bessemer show no change from those quoted last week, and are very firmly maintained, with very little iron for either spot or first half delivery. There is no interest as yet in third quarter deliveries. In foundry iron there has been a moderate quantity of business done, and prices are without change from those quoted last week. In gray forge there are inquiries for a very good tonnage, and prices are very firm. Southern gray forge is held at $20.85, Pittsburg, while Northern gray forge has brought as much as $21.25 at Pittsburg. We quote the market as follows:

Bessemer, valley furnace	$24.00 to $24.35
Bessemer, Pittsburg	24.90 to 25.25
No. 1 Foundry	23.75 to 24.00
No. 2 Foundry	23.00 to 23.25
No. 3 Foundry	22.25 to 22.50
Gray Forge, valley furnace	21.00 to 21.25
Gray Forge, Pittsburg	21.00 to 21.50

STEEL.—The steel market is very quiet. There is only a moderate inquiry, but as many consumers have very little steel ahead, there must necessarily be considerable buying in the near future. Prices are very well maintained at 35 for 4x4 billets and $36 for slab sizes and small billets, at mills, Pittsburg, Wheeling or valley. Sheet bars are firmly held at $36, mill.

FERRO-MANGANESE.—There is no change in the situation in ferro, and we continue to quote $125 for domestic 80 per cent.

RAILS AND TRACK MATERIAL.—The rail market shows no par-

ticular change. The mills have a very comfortable tonnage booked for the whole season. In track material there is the usual demand. We quote the market on rails and track material as follows: Rails, standard sections, over 200 tons, $35; 100 to 200 tons, $37; car lots, $38; less than car lots, $40; light rails, 25-pound and less than 50-pound, $37, all f. o. b. mill, Pittsburg; track material—spikes, 2.50c; track bolts, square heads, 3.60c; hexagon heads, 3.85c; splice bars 2.50c to 2.60c; links and pins, 3c to 10c.

BARS.—The market for steel bars is very firm and 2.25c continues to be the minimum in this district, with full half extras being charged. In iron bars there is no particular change. We quote refined iron bars at 2.40c, Pittsburg, and common iron bars at 2.15c, valley.

STRUCTURAL MATERIAL.—The outlook for structural mills is very good. There is sufficient tonnage on the books to run them into the season which is a busy one in almost all sorts of years. There is a good current demand for material for industrial plants, bridges, etc. There has been no change in prices and we continue to quote the market as follows: Beams and channels 3 to 15 inches, 2.25c; 18 to 24 inches, 2.35c; tees 2.30c; zees 2.25c; angles, 2.25c. Universal mill plates, 2 50c to 2.75c, according to delivery and size of order.

PIPES AND TUBES.—The two largest producing plants are again in operation after short shut-downs, and a good tonnage is being turned out. There is a fair demand for the season. We quote the market unchanged as follows: Merchant pipe, 50 and two 10's for car loads delivered within the specified territory; well casing, screw and socket joint, 37½; inserted joint, 32½, with an optional 5 per cent to dealers only; boiler tubes 1¼-inch to 1½-inch, 40 per cent off; 1¾-inch to 2½-inch, 50 per cent off for iron, and 55 per cent off for steel; 2¾-inch and larger, 52½ per cent off for iron and 55 per cent off for steel, with 5 per cent additional in carloads, less than carloads being f. o. b. mill.

PLATES.—The plate market shows some slight signs of increasing strength, but as yet prices are without material change. Some mills which were naming low figures have stiffened their demands. Prices on tank plate continue very irregular, and all the way from 2.25c to 2.50c as been named, the latter only on very wide plates. The bulk of the business is probably going at about 2.40c for assorted widths. We quote shell steel at 2.60c to 2.70c, flange, 2.70c to 2.80c and fire box 3¼c to 4c.

SHEETS.—The sheet market is a trifle firmer than at last report. Mills are unwilling in the majority of cases, to sell far ahead. Most of the mills have lined up to go into the consolidation and it is generally believed that not much work remains to be done in the way of winding up the negotiations. It is generally understood that the mills are all to take stock in the new company. It is possible that the working capital will be provided by the sale of stock, but it is understood that none will be put on the open market. We continue to quote No. 28 gauge, one pass through cold rolls, at 2.95c to 3c. Galvanized is in about the same condition as last week. It is probable that 75 and 10 could not be done, the mills generally quoting 75 and 5 to 75 and 7½, with a 15-cent freight allowance, while some mills are allowing only 10 or 12 cents.

SPELTER.—There is no great change in spelter from last week, and prime western grades can be had at 4 45c to 4 50c, Pittsburg.

OLD MATERIAL.—Most lines of old material continue rather scarce. We quote the market unchanged from last week, and nominally as follows, although there is a considerable range in views: Pittsburg, gross tons, except where otherwise specified: New basic melting stock, $31 to $33; new Bessemer melting stock, $26 to $27; basic open-hearth scrap, $31 to $33; steel rails, mixed lengths, $22 to $23; short lengths, $23 to$24; iron rails, $29 to $31; cast borings, $14 to $15, net tons; cast scrap, $18 to $20; No. 1 wrought scrap, $24 to $25, net tons; busheeling scrap, $16 to $18, net tons.

COKE.—There is still considerable difficulty experienced in getting shipments of coke. The car supply is now sufficient, but they are not being moved as fast as desired. Some furnaces have lost a few hours at a time, and have been kept busy watching their coke supply. The large coke pile which the leading steel producer has maintained for several years has been drawn upon considerably, and the steam shovel has been called into use in place of hand shoveling, but the stories that the whole pile is to be used up are probably erroneous. We quote strictly Connellsville coke at $2.75 to $3 for furnace and $3.25 to $3.50 for foundry.

CHICAGO.

Office of The Iron Trade Review,
1522 MONADNOCK BLOCK, Jan. 16.

With the exception of considerable sales of rails and a better demand for pig iron, the market remains about the same as last week, quiet and very firm. Dealers generally look forward to a much better demand than is had at present, and it seems more than likely that their expectations will be realized within the next few weeks.

PIG IRON.—The demand for Southern irons has increased considerably in the past week, and sales are somewhat larger than they were a week ago. A number of buyers are in the market, and it is expected that their orders will be placed this week. The demand comes from all classes of consumers, and is for lots from carloads up to 1,000 tons. The inquiry for small lots is surprisingly large, and keeps up well. Furnace representatives figure that a number of the larger buyers must come in the market to make purchases within a short time, and consequently they are looking for a largely increased trade within the month, or at least before the middle of next month. What business has been placed has gone at the quoted figures in every case, as buyers seem to realize that furnaces are not asking more than they can secure for iron, and make no difficulty about paying the asked prices. Northern irons are quiet, with only a small demand, which is satisfactory to the furnaces, as they are well sold ahead, and are glad of the opportunity to catch up on their orders. The difference in prices between Southern and Northern irons also has a good deal to do with the larger demand for the former. Furnaces, both North and South, find it difficult to keep up with their old orders, and are behind from three to six weeks on shipments. Quotations are continued as follows:

Lake Sup. Charcoal	$25 50 @ $26 50	Southern Coke No. 3	$20 85 @ $21 85
Local Coke Fdy. No. 1	25 00 @ 25 50	Southern No. 1 Soft	22 85 @ 23 85
Local Coke Fdy. No. 2	24 50 @ 25 00	Southern No. 2 Soft	21 85 @ 22 85
Local Coke Fdy. No. 3	24 00 @ 24 50	Southern Silveries	26 50 @ 27 00
Local Scotch Fdy. No. 1	25 00 @ 25 50	Jackson Co. Silveries	32 00 @ 32 50
Local Scotch Fdy. No. 2	24 50 @ 25 00	Ohio Strong Softeners	24 50 @ 25 00
Local Scotch Fdy. No 3	24 00 @ 24 50	Alabama Car Wheel	24 00 @ 26 00
Southern Coke No. 1	22 85 @ 23 85	Malleable Bessemer	24 00 @ 25 00
Southern Coke No. 2	21 85 @ 22 85	Coke Bessemer	35 00 @ 26 00

BARS.—There is a good demand, most of it coming in small lots, although some inquiry has been had for large quantities, and sales have been made of round lots for forward shipment. The market is firm and unchanged at 2.30c to 2.45c for iron, and 2.35c to 2.50c for steel bars, half extras, Chicago delivery.

RAILS AND TRACK SUPPLIES.—Sales of about 25,000 tons of rails have been made in the past week for delivery in this territory, the larger part having been taken by local mills. There is some figuring on still other large lots, and it is thought this will result in further sales within a short time. Quotations are as follows: Rails, standard sections, $35 to $38; light sections $37 to $42; splice bars, 2.50c to 2 70c; spikes, 2.75c to 2 85c; track bolts, 3.65c to 3.85c.

BILLETS AND RODS.—There is some demand for both billets and rods, but what sales are made are taken by mills farther East, as the local mills are sold up for some time ahead, and are not looking for business. Bessemer billets are quoted at $35, and sheet bars at $36, Pittsburg, with $2 added for Chicago delivery. Rods are not quoted by the local mills, but are being sold at $55 for Bessemer and $65 for open-hearth by Central Western mills.

PLATES.—The market is not strong, and some sales have been made by mills East of here at a considerable concession from the prices we quote. The demand is somewhat better, and sales last week were larger than in the week previous. We quote tank steel from store 3.10c to 3.20c. Mill shipments Chicago delivery: Tank steel, 2.65c to 2.70c; shell, 2.75c to 2.80c; flange, 2.80c to 3c; marine, 3c to 3.10c; fire box, 4c to 6c, according to brand.

STRUCTURAL MATERIAL.—The only large order closed in the week was one for something over 3,000 tons of bridge material, placed with a Pittsburg mill by a local bridge works. The expected advance has not yet been made on beams, but it is looked for in the near future. Quotations follow:

Beams, 15 inches and under, 2.40c; 18 inches and over, 2.50c; angles under three inches and over six inches, 2.50c; three inches to six inches, 2.40c; sheared plates, 2.65c to 2.75c; universal plates, 2.75c to 2.80c; tees, 2.45c; zees, 2.40c; small lots from store are quoted from ¼c to ½c higher.

SHEETS.—There is not very much demand, except for small lots, of which the tonnage closed last week was good. There is no change in quotations, which are made at 3c to 3.20c for No. 27 black, and 70 and 5 to 70 and 10 per cent off for galvanzied.

MERCHANT PIPE.—The demand is still light, and sales in the week were limited to comparatively small lots. Most of the business placed was for store shipment. There is no change in prices, although an advance is expected soon. Quotations are made at 50 and two 10's off for mill shipment on large orders, and 50 and 10 and 5 off for small orders.

MERCHANT STEEL.—The demand has been fairly good, and some quite large lots were placed last week, although most of the demand was for comparatively small lots. Local dealers look for an increase in the demand within the next few weeks. Smooth finish tire steel is quoted 2.80c to 3c; smooth finish machinery steel, 2.95c to 3.05c; spring steel, 3.65c to 3.75c; tool steel, 7c to 7.50c; special, 13.50c and upwards.

WIRE AND WIRE NAILS.—There is no change in the situation from last week. The demand is large, and good sales were made in the week, with an excellent prospect for the future. Makers quote single carloads of wire nails at $3 53 f. o. b. Chicago, and $3.63 for less than carloads. On wire, current quotations are as follows: Plain annealed wire, $3.38; painted barb wire, $3 98; galvanized barb wire, $4.13.

OLD MATERIAL.—There was not much business closed and the market is not very strong, although most dealers are holding firmly to the prices quoted below. It is expected that the demand will be better and sales larger within a short time. Dealers' selling prices are as follows:

Old iron rails, gross,	$26 00@$27 00	Country malleable	$14 50
Old steel rails, long, gr.	23 50@ 24 00	Iron axles, net	$28 00@29 00
Old steel rails, mixed	19 50@ 20 00	Cast borings, net	10 00@11 00
Relaying rails, gross	28 00@ 30 00	Wrought turnings, net	11 00@12 00
Old wheels, gross	22 50	Iron axle turnings, net	14 00@15 00
Railroad forge, net	24 00	Steel axle turnings	12 00@12 50
Dealer's forge, net	16 50@ 17 00	Mixed country steel, gr	15 00
No. 1 cut mill, net	14 00	Stove plates, net	10 00@10 50
Heavy cast, net	14 50@ 15 00	Heavy melting steel, gr	19 00@19 50
Railway malleable, net	16 00	Old iron splice b., net	26 00

CLEVELAND.

OFFICE OF *The Iron Trade Review*,
27 VINCENT ST., Jan. 17.

The local pig iron market continues quiet apart from the small lot business that is a constant factor. Foundrymen who are expected to make further contract purchases for the first half of the year are not yet moving in the matter. Meantime prices are unchanged. Furnace operations in the two valleys do not indicate that any increase in supply may be expected soon. The No. 1 furnace of the National Steel Co. at Youngstown is not likely to be in blast until the latter part of February and the No. 2 furnace may be two months later or more. The coke supply is still unsatisfactory. A few furnaces were banked for a day or more at a time in the past week because they were short of coke. Cars for the ore docks are somewhat more plentiful; but furnace operation is still largely a day-by-day affair. The advance in freights that went into effect on Jan. 1 have been very considerable. Northern Ohio furnaces that have been in the habit of shipping across the State find that to some points a 50 per cent advance has been made on pig iron, or from $1 to $1.50. This will restrict the trade in question to Southern Ohio furnaces, so far as Northern pig iron is concerned.

Where small lots of Bessemer iron can be had for immediate delivery they are bringing from $24 to $24.25, at valley furnace. This sort of business is all that is going. An inquriy for a round lot was made recently, shipment in the second quarter, but it could not be entertained. A Shenango valley steel plant is still shut down, while the metal from its furnaces is sent to Youngstown to keep the plant there in full operation. In forge iron there is practically nothing offering. An odd lot that the furnace did not want to pile was sold at $20.50, delivered in the valley, but it is doubtful if $21, valley, could be bettered on a contract order. Southern, at $16, Birmingham, is $20.45 delivered in the valley. We continue quotations unchanged:

Bessemer	$24 50	Valley Scotch No. 1	$23 00@23 50
No. 1 Strong Foundry	23 00@ 23 50	Valley Scotch No. 2	22 50@23 00
No. 2 Strong Foundry	22 50@ 23 00	Gray Forge, valley	21 00@21 25
No. 3 Foundry	21 50@ 22 00	Lake Superior Charcoal	25 00@26 00

FINISHED MATERIAL.—The plate and sheet markets show more firmness. Tank steel has sold in this market recently at 2.45c, Pittsburg mill, and the 2 25c basis recently reported on some closely competitive orders is not now heard. The Spitzer building at Toledo, calling for 850 tons of structural material, is not yet let. The outlook for the structural trade in general is reported excellent, and mills are well supplied for the next few months. The bar iron situation is strong. New business is being entered by the mills with every week, though the movement from store is only moderate. We continue to quote 2.15c for common at valley mill in carload lots, not more than five sizes, with extra charge for cutting. Steel bars are firmly held at 2.25c, Pittsburg mill, with a higher basis for small lots, for early shipment. The sheet market is firmer in view of the consolidation prospects and the unwillingness of mills to take business on the present basis for more than 60-day deliveries. We quote No. 27 at 2 85c to 2.90c, Pittsburg. There is considerable demand for wrought iron pipe, some work for the spring being already under negotiation.

OLD MATERIAL.—Demand is not active, though consumption is very heavy. The usual railroad sales are being made, at practically the prices that have prevailed for several weeks. We quote machinery cast scrap at $17 to $18; No. 1 railroad wrought at $23.50 to $24; wrought turnings, $14; cast borings, $12.50 to $13; busheling scrap, $16.50 to $17. Iron rails are scarcely dealt in. Perhaps the most activity is in steel melting stock. We quote old steel rails at $21.

WIRE AND WIRE NAILS.—The rod mill strike is not likely to be felt in the wire market for the present at least, as rods are being brought to Cleveland mills from other plants. There is good promise for spring business in both wire and nails. We quote wire nails at $3.35, Pittsburg mill, in carload lots to retailers and $3.20 in carload lots to jobbers; smooth wire $3.20 in carload lots to retailers and $3.05 to jobbers; barb wire $3.75 for painted and $3.80 for galvanized to jobbers, with 15c advance to retailers. Freight to Cleveland is to be added for local prices.

CINCINNATI.

Jan. 16.

Rogers, Brown & Co., say: "As has been expected, the buying movement has set in again and though as yet transactions have not been of a remarkably large tonnage, there are numerous inquiries for round lots, which, together with the fresh demand for small quanities, gives quite a spirit to the market to which it has been a stranger for the past two or three weeks. There is no special feature marking the week under review. There continues to be a great scarcity of desirable soft foundry grades. The demand for malleable and car wheel iron in both charcoal and coke qualities is quite large again, and some of the prominent manufacturers of these classes of iron are unable to make quotations at all for delivery this side of July, and prices are necessarily ruling firm with a tendency to higher values."

Matthew Addy & Co. refer to the situation in these terms: "The increase in inquiry which we mentioned last week is still in evidence. The buying that is being done now is for comparatively short deliveries. It is evident that a good many people are needing iron and they are having considerable difficulty in securing it for anything like prompt shipment. The majority of consumers, however, are playing a waiting game. They are sitting on the fence apparently undecided which way to jump, or, in other words, they are waiting to see if they can tire out the furnaces. It certainly seems as if they would be compelled to wait a long time to do this, for an overwhelming proportion of all the iron that can be made in the South up to July 1st has already been sold. The iron masters there are in position simply to sit and wait for six months if necessary without feeling the slightest anxiety. It is patent to all students of the situation that consumers are not in anything like this position. In fact they will need iron long before the iron masters will have any considerable

quantity free to deliver. There is not one weak spot in the situation."

We quote for cash f. o. b. Cincinnati: Southern coke No. 1 foundry, $21.75 to $22.25; Southern coke No. 2 foundry, $20.75 to $21.25; No. 3 foundry, $19.75 to $20.25; No. 4 and gray forge, $19 25 to $19.75; No. 1 soft, $21.75 to $22.25; No 2 soft, $20.75 to $21.25; Lake Superior coke, No. 1, $24 to $24 50; No. 2, $23.50 to $24; Hanging Rock charcoal, No. 1 $25 to $26; Jackson county silvery, No. 1, $30 to $31; standard Georgia car wheel, $24.75 to $26.25; Lake Superior charcoal, $25.50 to $26.50.

PHILADELPHIA.

Jan. 16

Pig iron stocks so far as reported by producers, show an increase of 13,600 tons between Dec. 1 and Jan. 1, which considering the usual tendency at the end of the year is regarded as favorable to the furnaces. The stoppages of Southern furnaces in the holiday week and the reports coming from Pennsylvania and farther Western points of inability to get sufficient coke supply indicate that the ability to increase production or even maintain it continuously at the present point is not the certainty that it has been taken to be in some quarters. If a demand should appear soon for considerable lots of pig iron, it is not improbable that slighly higher prices would result. There are some consumers of foundry and forge iron now feeling the market and large orders are involved; but there is apparently no hurry about the matter. Buyers think ruling prices are high and are looking for concessions. Though here and there small lots of other than standard irons are said to have gone at a trifle below generally quoted prices, it appears that buyers are given no encouragement to expect any yielding on their purchases for the second and third quarters of the year. The deadlock may not be broken by a strong buying movement but the indications are that purchases will be made at intervals, with a close watch upon general conditions, to take advantage of any change that may come. The fact appears to be that many foundries have large contracts to deliver castings and are taking on more, and must cover for work actually in hand. The argument of the buyer who thinks the time has come for lower prices is really sentimental, while that which grows out of the actual conditions seems to be on the side of the seller. There has been a fair demand for small lots of pig iron in the past week and the indications are that by another week the volume will be larger. We make no change in quotations: No. 1X foundry, standard brands, $25 to $25.50; No. 2X foundry standard brands, $23.25 to $24.25; No. 2X, plain brands, $22.25 to $22.75; Gray forge, standard brands, $20.50 to $21. In finished products there is a fair demand and mills are running right along with full force, while some are well sold for three months and longer. Plates continue weak, the effect of expected additional capacity showing itself in some anxiety to get a good tonnage on order books to run up to the really active period of outdoor operations. We quote tank steel at 2.40c, and lower prices have been made where bids on farther western business have been in competition with Pittsburg mills. In bars there has been some variation in price, as low as 2c having been done on large sizes; but the usual range of quotations on assorted sizes is 2.10c to 2.15c for refined iron, smaller sizes being held at 2.20c. Sheets are unchanged at 3 20c to 3.30c for No. 28 delivered. We quote old material as follows, some little difference appearing between delivered prices bid and asked, but for the present conditions are rather in the buyer's favor: Choice railroad scrap, $24 to $26; No. 1 yard scrap, $20; No. 2 light scrap, $13.50 to $14.50; machinery cast, $17.50 to $18.50; heavy steel scrap, $20 to $21.50; old iron rails, $25 to $27; old steel rails, $21.50 to $22 50; wrought turnings, $15 to $15 25; cast borings, $13.75 to $14.25; old car wheels, $20 to $22; iron axles, $26 to $28; steel axles, $25 to $27.

Within the past 30 days the National Tube Co. has shipped to European ports 2,160 tons of pipe, nearly 1,000 tons to South America, 500 tons to Japan, and 288 tons to China. Smaller lots were sent to Cuba, Singapore, Manila, Bombay, and Melbourne.

STRIKE OF ROD MILL WORKERS.

The demand of union rod mill workers upon the American Steel & Wire Co., noted one week ago, was not granted by the company and within the week strikes have resulted in some of the mills. The workers are not by any means a unit on the matter. Their demand was for the signing of a scale providing for increases ranging from 3 to 20 per cent, and giving most of the men an advance of 10 per cent, or 2½ per cent additional to the 7½ per cent voluntarily granted by the company at the beginning of the year. Recognition of the union seems to be, however, the main contention. The company's mills have been open heretofore and outside of Cleveland the union has little foothold. On Monday, Jan. 15, the rod mill men in four Cleveland mills were out—the American, HP, and two Newburg mills, but the Baackes plant, in which the men are not organized, was operated as usual. At Beaver Falls, Pa., part of the men went out on Tuesday, but more than half were at work. At the Braddock and Rankin plants comparatively few men went out, and as the New Castle plant has been closed down recently there was no issue there Indications are that the division of opinion in the men's own ranks may make the trouble short-lived. It is reported that in the Cleveland district the boss rod rollers have withdrawn from the union, believing that the men have no grievance in the face of the voluntary increase recently made by the company. Erroneous claims were made by the men on Wednesday, Jan. 17, that the strike had effected operations in nine plants—the four in Cleveland, three in the Pittsburg district, and the mills at New Castle, Pa., and Anderson, Ind. A dispatch from Pittsburg says that at the Braddock and Beaver Falls rod mills most of the men are out, but the Rankin plant is in operation, the men there not being organized. Officers of the union in Cleveland expected to have a conference with District Manager De Forest on Wednesday.

Chairman Gates made the following statement at Chicago on Monday: "Our company has 28,880 men on its pay-roll. Of this number not to exceed 400 are in the Cleveland district, asking for an advance of 10 per cent as against the advance of 7½ per cent which we granted on Jan. 1. These men are known as rod mill men and work in four of our rod mills, all in Cleveland, and will probably cause us to suspend operations in three rod mills and possibly three wire mills. We have a total of 21 rod mills and are taking the product of three more under long time contract, so that we have the product of 20 mills out of 24 running day and night, which is practically all the rods we can dispose of in finished product. We do not anticipate any serious trouble, nor will there be any interruption of the business whatever as we have probably 100,000 to 150,000 tons of finished product on hand which we can ship, which is a month to six weeks' supply. It is barely possible that these men may object to the 2½ per cent that we are putting in a sinking fund for the benefit of all our mill employes. In any event the labor trouble is not serious and it wouldn't materially interfere with our output if none of these mills were operated in the present year."

The Star Corundum Wheel Co., of Detroit, manufacturer of corundum and emery wheels, of emery wheel dressers and cutters and of grinding machinery, has established agencies in the past two months as follows: Monroe Brass & Wire Co., Neave Bldg, Cincinnati; Standard Supply & Equipment Co., Pittsburg; W. C. Heimbuecher, 36 La Salle st., Chicago; H. A. Heppner & Co., Portland, Ore. These are in addition to the company's regular traveling salesmen who are on the road continually.

At Macungie, Pa., the repairs to the furnace of the Empire Iron & Steel Co. are completed and the furnace is now in blast, after having been idle for the last 10 years. Its capacity is 80 or 90 tons a day.

Miller Brothers & Co., of Pittsburg, have a contract to build five 50-ton open-hearth furnaces for the American Steel & Wire Co. at Cleveland, together with five soaking pits and gas producers. The business of Miller Bros. & Co. is to be incorporated as the Miller Engineering Co.

THE IRON AND STEEL STOCK MARKET.

Fluctuations of the Week and the Year.

The table below shows the changes in the iron and steel stocks in the week ending Jan. 15, also the high and low points for the year:

Name.	WEEK.				YEAR.					
	Open	High	Low	Close	High.			Low.		
Am. Car & Fdy	13⅜	13⅜	12⅝	13	14¾	Jan.	4	12⅝	Jan.	15
Am. Car & Fdy pr.	62	62	59⅞	59⅞	62½	Jan.	4	59½	Jan.	2
Am. Steel & Wire..	46⅛	49	45⅜	46⅝	50½	Jan.	3	45⅜	Jan.	15
AmSteel & Wire pr	90⅝	91	89	89⅜	92⅜	Jan.	3	89	Jan.	15
Am. Steel Hoop.....	42½	42½	42	42	45	Jan.	3	42	Jan.	8
Am. Steel Hoop pr	82	82	81	81	83	Jan.	2	81	Jan.	10
Am. Tin Plate.....	31⅜	31⅞	26⅜	28⅛	34½	Jan.	3	29	Jan.	2
Am. Tin Plate pr..	81	81	80½	80⅝	83	Jan.	2	80⅝	Jan.	12
Col. Fuel & Iron...	46½	43¾	40½	43	46⅝	Jan.	3	40⅝	Jan.	8
Federal Steel.....	51⅜	52¼	47¾	50⅝	55⅜	Jan.	2	47¾	Jan.	11
Federal Steel pr....	73	74½	70¾	72¼	76	Jan.	2	70¾	Jan.	10
National Steel.....	41	43	41	41⅜	46½	Jan.	3	41	Jan.	8
National Steel pr..	92⅜	92½	92	92½	93	Jan.	2	92	Jan.	9
Pressed Steel Car..	57	58⅛	56¼	58	58⅛	Jan.	15	56½	Jan.	2
PressedSteelCar pr	86	86	85¼	85	86½	Jan.	4	85¼	Jan.	9
Republic Steel	21	22	19⅓	20	23¾	Jan.	3	19⅓	Jan.	15
Republic Steel pr..	65¼	65¼	65	65	68¼	Jan.	5	65	Jan.	11
Tenn. Coal & Iron	82⅜	85¼	79⅜	83	87¾	Jan.	3	79	Jan	11

Notes.

An additional $2,000,000 of common stock of the Colorado Fuel & Iron Co. is to be listed on the New York Stock Exchange, making a total of $15,000,000 of listed stock. The increase is for improvements at the company's plants.

President Guthrie, of the American Steel Hoop Co., is quoted as follows on the outlook: "The demand from the railroads and for structural material is nothing short of astonishing. In our business we are faring wonderfully well. In the month of December—the dullest month of the year, because every one is taking inventory—we received as many new orders as we sent out. We have, in fact, business on our books clear up to July next. Half of finished product and all of our pig iron production up to that time are sold. Our profits were $3,000,000 up to Jan. 1, with four months of the fiscal year yet to run. We are running just as full as we can; indeed, all the steel companies are. As for the outlook for the future, it is most encouraging. The facts that all the companies are spending thousands upon thousands of dollars for improvements shows how great is their faith in the future. I can see nothing whatever to disturb conditions."

At the annual meeting of the Pressed Steel Car Co., Pittsburg, E. A. Schoen and F. N. Hoffstot were elected directors in place of C. L. Freer and E. M. Dickerson. The office of first vice-president was abolished, and the officers are now as follows: C. T. Schoen, president; W. H. Schoen, vice-president; W. C. DeArmond, secretary, and W. O. Jacquette, treasurer. In the statement of the president it was shown that the total business operations of the company for the year 1899 were $13,965,572.19. The total output was 9,624 cars, 127,656 bolsters and 50 926 truck frames, besides other miscellaneous parts. The orders on hand on Jan. 1, 1900, to be executed during 1900, amount to $16,596,863 43. The net earnings for the year 1899 were $2 237.103 85, out of which a dividend of 7 per cent on the preferred stock, amounting to $875,000, has been declared. A further dividend has been declared on the common stock, equal to 6 per cent, or $750,000, one-fourth of which is payable on February 9, and the balance in quarterly payments on May 21, Aug. 20 and Nov. 19, 1900. After all of these declared dividends have been paid there still remains for additional working capital of the company a surplus of $612,103.85.

A telegram from Chicago says that Jones, Cæser & Co., chartered accountants of Chicago and New York, are now engaged in an expert survey of the books and accounts of the American Steel & Wire Co., from which they will make a careful report for submission to the governors of the London Stock Exchange, or rather its listing committee, with an application for the admission to the Bourse of Steel & Wire securities. A copy of the same statement will be filed with the New York Stock Exchange, according to the regulations.

The Cambria Steel Co. has declared a quarterly dividend of 50 cents per share, payable Feb. 15, to stock registered Jan. 1, and has called an assessment of $1.50 per share, payable eb. 1, on stock registered Jan. 31. There has also been declared an extra dividend of $1.50 per share, payable only for the purpose of enabling stockholders to make payment of the assessment.

John W. Gates has denied the reports that he will resign as chairman of the board of directors of the American Steel & Wire Co.

Frick Coke Co. Changes.

The official statement concerning the result of the Frick Coke Co. meeting last week is as follows: "At a meeting of the stockholders of the H. C. Frick Coke Co., held in Scottdale, Pa., Jan. 9, 1900, the following board of directors was electd: Henry C. Frick, Thomas Lynch, George Lauder, James Gayley, D. M. Clemson, Andrew M. Moreland and Thomas Morrison. The number of directors was increased from five to seven. John Walker and Giles B. Bosworth, members of the old board, retired, and Messrs. Gayley, Clemson, Moreland and Morrison were elected to fill vacancies and new memberships. The board today re-elected the old officers and at the suggestion of Mr. Frick abolished the office of chairman held by himself." The four new directors are well known as members of the board of managers of the Carnegie Steel Co., Ltd. Although Mr. G. B. Bosworth retires from the board he retains the offices of vice-president and treasurer of the company. President Lynch, First Vice-President W. C. Magee and Secretary M. M. Bosworth were also re elected.

The retirement of Mr. Frick was not unexpected, being in line with the change in the Carnegie Steel Co. organization recently announced, and was a surprise only to those who have entertained the erroneous idea that he had majority holdings in the H. C. Frick Coke Co. It may be stated in this connection that there are good reasons for believing that Mr. Frick will withdraw as consulting partner in the Carnegie Steel Co., and dispose of all his interests in that company and the H. C. Frick Coke Co.

The National Steel Co.'s employes at Sharon, Pa., have been given an advance in wages averaging 10 per cent.

The Philadelphia Furnace, at Florence, Ala., has resumed operations after an idleness of seven years. The furnace will receive its supply of ore from the Russellville district, where the Sloss-Sheffield company owns large tracts of valuable ore lands.

The demand for iron ore has been so great that the mines near Blacksburg, S. C., are being worked under adverse circumstances. About 100 hands are employed getting out gray magnetic ore, which is sent by rail to furnaces at Greensboro, N. C., 120 miles distant. But to get the ore to the railroad requires its being hauled in mule and ox wagons five miles over rocky roads, the loading and unloading being done by hand.

F. H Bullman & Co., 106 and 108 Canal st., Cleveland, center attention in their literature for 1900 upon their Superior automatic gear cutters. The catalogue before us presents a series of questions concerning these machines, and the manufacturers' answers. For example: "What is the heaviest pitch these machines will cut in good quality cast iron, without undue strain upon the machine? With what speed of feed can the cutter be driven? What width of face will they cut? Have the work arbor and cutter spindle outside supports? Can the work be turned for inspection?" Concerning bicycle sprockets it is stated that 40, ⅛ inch thick, can be cut at one time and from 600 to 800 20-tooth spockets can be cut in 10 hours. Of these machines the Nos. 1, 2 and 6 will cut spur, bevel and worm gears, and Nos. 3, 4, 5 and 7 spur gears. The machines are guaranteed to cut gears within their range to vary not more than .002 of an inch at any point.

The Montpelier, Ind. tin plate mill has closed down and probably will not resume. Montpelier people gave a $27,000 bonus for the plant, and may start injunction proceedings.

The E & G. Brooke Iron Co.'s plant at Birdsboro, Pa., has been shut down for several days from lack of coal, and the Reading Iron Co. is much hampered by short supply.

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AND
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THE BRITISH INDUSTRIAL CRITIC AT HOME.

"Faithful are the wounds of a friend." British manuacturers have had frequent occasion to take consolation from this reflection in the past year or two. Perhaps no feature of British trade and technical literature in this period has been more remarkable than the freedom with which shortcomings at home and superior attainment by the United States have been held up for the reproof and instruction of the British reader. In a recent address before the Fortnightly Club of Tarrytown, N. Y., F. A. Halsey, associate editor of the *American Machinist*, alludes in the following apt sentences to this phase of English trade journalism:

> No more striking revulsion of feeling was ever seen than that which has taken place in England during the past two years regarding the merits of American mechanical products. Not less remarkable, however, is the frankness and candor with which it has been expressed. The English technical and daily papers have fairly vied with one another in telling disagreeable things to their constituents. No American paper would have dared do the same thing had the circumstances been reversed. The American people too dearly love to hear the eagle scream to tolerate such action. Not only in the public press, however, has this spirit been seen. Private individuals in conversation, and conspicuously in papers before English technical societies, have been open-mouthed in voicing their admiration of our products and methods, and in many cases this admiration has been carried to absurd lenngths. From numerous articles which have appeared in publications of the front rank, one would infer that we have here a province of Utopia, where not even man is vile, and where every workman lies awake o' nights contriving how to increase his output. If he runs one machine he is said to be anxious to run two, and if he already runs four he is equally anxious to run five. Perhaps, however, the most curious of all these exaggerations is that which looks upon that football of politics, our consular service, as quite the model for all the world!
>
> The same spirit has been shown in estimating the merits of our products. Through low prices or quick delivery we have sold many things in English markets, and, in a condition of semi-panic, virtues have been attributed to them far in excess of the truth. Instead of minimizing these virtues, the tendency has been to exaggerate them. These very exaggerations, however, only serve to emphasize the spirit of candor already referred to. No discussion of this subject could be complete if it failed to acknowledge this spirit, which no one can see as it is manifested in the original without acquiring an increased respect for the English people. A race which is given to such inward searchings and to such acknowledgments, even though in a measure unwarranted, of the fact that, for the time being, it has been left behind, cannot be permanently worsted in the industrial race.

Now and then an article appears giving reasons for thinking the flood-tide of prosperity had been reached. So far as values go, there were indications in December that the high point had been touched in several staple lines, but *Bradstreet's* price index numbers showed a net gain Jan. 1, 1900, of a fraction of 1 per cent over Dec. 1, 1899, being 90,971 as against 90,783. Those who draw conclusions respecting the iron market from the general situation are apt to be misled, for the course of the iron trade for some time may be dominated by influences within itself. But looking to the larger movement that may ultimately affect all industry, the statistical summary just issued by the Treasury Department indicates that the favorable trade balance in the calendar year 1898 was very considerably reduced in 1899. In the former year the total of merchandise exports was $1,255,546,266; in 1899 it was $1,275,486,641—a gain of about $20,000,000. The merchandise imports in 1898 were $634,964,448; in 1899, $799,834,620—an increase of $165,000,000. The excess of merchandise exports which in 1898 was $620,581,818 fell to $475,652,021 in 1899, a decline of $145,000,000. In December, merchandise imports were $71,547,273, a gain of $16,000,000 over December, 1898, while merchandise exports were $123,285,163, a loss of about $14,500,000 from December, 1898. Our prosperity has led to the importation of large amounts of foreign raw material to supply our crowded workshops. However, these figures for imports and exports lose significance in the face of the extraordinary pressure upon industry everywhere, at home and abroad. The great export trade balance of 1898 gave an impetus to the splendid domestic movement now everywhere in evidence; but the increase in trade at home that has come in the past year many times makes up for the decline that has come in the balance with foreign countries.

THE Western Pig Iron Association, on the basis of nearly complete returns, puts the pig iron production for 1899 at 13,626,182 gross tons. The official returns of the American Iron and Steel Association will probably be available by another week. The output last year is to be compared with 11,773,934 tons in 1898, a gain of nearly 2,000,000 tons. It was 5,000,000 tons in excess of the production in 1896, and more than double the 6,657,355 tons produced in 1894. The decade opened with 9,202,703 tons in 1890. The probabilities are that the record for 1900 will exceed this by at least 5,000,000 tons. The fluctuations in the past 10 years have been very considerable.

The Pittsburg Steam Engineering & Mfg. Co. has been chartered at Trenton, N. J., with $300,000 authorized capital stock.

PERSONAL.

J. R. Phillips, formerly manager of the Laughlin plant of the American Tin Plate Co., has been appointed manager of the Pittsburg district of the company, to succeed John C. Oliver, who resigned to become manager of the Oliver Iron & Steel Co 's plant.

Alfred C. Gary, teller of the Merchants' Loan & Trust Co., Chicago, has resigned to accept the position of treasurer of the Lorain Steel Co., Lorain, O. Mr. Gary is a cousin of E. H. Gary, president of the Federal Steel Co.

Brown Caldwell, recently secretary of the Peerless Rubber Co., has accepted the position of general Eastern representative of the Sargent Co., of Chicago, and will have offices in Pittsburg and New York City.

Charles A. Moore of Manning, Maxwell & Moore, sailed on the steamship Columbia of the Hamburg-American line last week for Mediterranean ports and Egypt. Mr. Moore is accompanied by his family and the trip is said to be purely one of rest and recreation. It will be surprising, however, if a man of Mr. Moore's life-long business habits refrains from contact with business interests at some of the important European centers.

L. C. Hanna, so well known in the iron trade as the managing head of M. A. Hanna & Co., Cleveland, has gone to Palm Beach, Fla., for a stay of some weeks in the hope that his health, which has been somewhat impaired recently, will be restored. Later Mr. Hanna will probably go abroad for an extended stay.

The names of John W. Gates, Isaac L. Elwood, Wm. Edenborn and James J. Hill have been selected for the four 500-foot steamers of the American Steamship Co. that are now under construction, with the expectation that they will be ready for service by April 15. These gentlemen are all prominently connected with the American Steamship Co. which is the vessel-owning organization closely allied with the American Steel & Wire Co.

Harry Kennedy, a Pittsburg engineer, returned this week from Mariopol, Russia, where he has been for a year in charge of blast furnace erection for the government. Mr. Kennedy is a cousin of Julian Kennedy, the well-known consulting engineer, who has been doing a great deal of Russian work.

Industrial Notes from a Busy Ohio City.

Geo. A. Kempel & Co., of Akron, O., one of the largest heavy hardware concerns in the state, reports a large increase for the past year in business over 1898. The great specialty of the company is comprised in a very extensive trade in wagon supplies, six floors of the immense store being utilized for storage of materials of that character.

A. Adamson, of Akron, O., notes an increase of about 30 per cent in the business of last year as compared with 1898. Mr. Adamson's foundry capacity has been doubled by the addition of new buildings besides the installation of new machinery in the shops. Dies, molds and rubber machinery are manufactured and the necessary patterns and castings are also made in addition to general foundry work. About 60 men are employed.

J. K. Williams, of Akron, O., manufacturer of dies, molds and machinery for rubber work reports a steady increase of business with numerous orders ahead for the present year. Mr. Williams has been in his present line of work for 15 years and at present employs 22 men. In addition to the specialties mentioned this plant does general machine shop and repair work.

The Star Drilling Machine Co., of Akron, O., has nearly completed its new foundry building, which will give an added capacity of 40 per cent. The increase in business for the past year over 1898 is given as 50 per cent. A force of about 140 men is employed and a large trade is done in portable well drilling machinery.

The Selle Gear Co., of Akron, O., reports an increase of 20 per cent in business during the past year. The company was incorporated in 1885 and is an extensive manufacturer of spring wagon gears of light and heavy varieties, about 60 men being employed at full capacity. The Replogle Governor works, on the grounds of the above company, report a very satisfactory year in the manufacture and sale of water wheel governors.

Recent Company Elections.

The Pittsburg Steamship Co., which was chartered in Pennsylvania sometime ago to own and manage the vessels connected with the Carnegie-Oliver ore interests, held a meeting for organization at Pittsburg last week. H. W. Oliver was elected president; James Gayley, vice-president; E. S. Mills, general manager; C. D. Fraser, secretary, and H. C. Daft, treasurer. The company's fleet will consist of 13 boats, the six now building, the four taken over from the Lake Superior Iron Co. and the Linn, Carrington and Black, purchased about two months ago. They will be managed from the Cleveland office.

At a meeting of the stockholders of the Alabama Steel & Wire Co., at Ensley, Ala., on Tuesday, Jan. 16, the following officers were elected: President, E. T. Schuler; secretary and treasurer, G. H. Schuler. These with James Bowron constitute the board of directors.

The stockholders of the Brier Hill Iron & Coal Co. held their annual meeting at Youngstown, O., Jan. 16, electing the following directors: George Tod, Henry Tod, William Tod, J. G. Butler, Jr., and H. H. Stambaugh. The directors elected George Tod, president; Henry Tod, vice-president; J. G. Butler, Jr., general manager; H. H. Stambaugh, secretary and treasurer.

Active French Market for American Machinery.

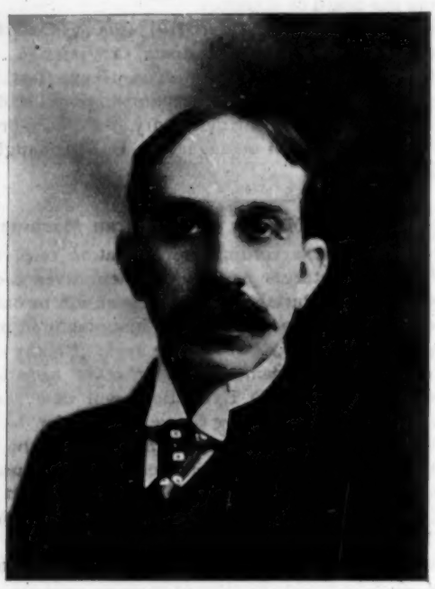
There is no doubt, according to information received from Paris by manufacturers having representatives there, that the French market during the current year will be one of the most active for the sale of American manufactured products. The New York *Journal of Commerce* says: "Many concerns in this country who by some means or other have failed to procure space at the Paris Exhibition, will nevertheless, be represented in that city during the year in order to capture any trade there may be obtainable and also to be able to show their products. Extraordinary activity still prevails in every engineering line throughout France. It will not be until the exhibition is near the end that the manufacturers in the line of heavy work can make deliveries for foreign requirements. This will mean that French exporters will have to resort to foreign purchases in order to meet this demand. The price of coal is said to have been so materially advanced in that country that a number of mills were early this month trying to secure advantageous terms in England, and in some cases mine owners and merchants in this country were receiving communications on the subject. In the machinery and tool lines the demand from France has been unprecedented this season. Forwarding agents say that for Havre alone thousands of dollars' worth of machine tools are being booked on freight lines for the rest of this month and all through February. Nearly $25,000 worth was sent to that port from here last week and twice that amount will go during this week. Electrical material shipments are growing at a rapid pace; while these have for a period of three or four months averaged from $10,000 to $15,000 weekly, those of the first week in January have reached $75,000, and from information obtained by leading electrical companies, they will for some months to come continue very large. The trade in less valuable merchandise with France is also said to be active. In such branches as hardware, photographic material, plated ware, agricultural implements of the higher class and other such merchandise the business is in the hands of export commission houses with very few exceptions. Even in brass fittings for mechanical use, orders are being executed for France. In these minor articles there is as much going to Marseilles as there is to Havre, which shows that their use is becoming quite general all over the country."

THE New York Air Compressor Co.'s new shops at Arlington, N. J., commenced operation in all departments but the foundry on Jan. 2, and the company expects to have its foundry at work by Feb. 1. Although organized but a little over 60 days, the sales record of the company is unusual, orders having been placed with it sufficient to tax its capacity for three months. Plans have been made to double the shop equipment at once, and the plant will be operated day and night until this can be done.

THE SELLING SIDE OF THE TRADE.

Representatives of Well Known Iron and Steel and Equipment Firms.

Eliot Abbot Kebler, of Pittsburg, is an example of the technical man who has made his training effective on the commercial side of the iron trade. He is a graduate of the University of Cincinnati, from which he received the degree of B. S. in 1883, having devoted himself particularly to the chemistry of iron. While in his university course, he spent a summer in one of the iron districts of the South, examining an ore property for a Cincinnati interest, and after his graduation he became chemist for the Cincinnati & Newport Iron & Pipe Co. This became the Addyston Pipe & Steel Co. in 1887. In 1896 when Mr. Kebler resigned, he was secretary of the company. Going to Pittsburg he opened an office in the Second National Bank Building as resident agent of Matthew Addy & Co., of Cincinnati, his territory taking in



ELIOT A. KEBLER.

the western half of the state. This agency he has today and also does a general brokerage business in iron and steel. Mr. Kebler has taken an active interest in the Pittsburg Foundrymen's Association and has been influential in it both because he is personally popular and by reason of the part he has taken in the association's discussions, bringing to them both the laboratory and the foundry view. He has been twice elected a member of the executive committee and at the convention of the American Foundrymen's Association last year was chairman of the reception committee.

Connellsville Coke Shipments in 1899.

The Connellville *Courier's* statistics show that the shipments of coke from that region in 1899 were 523,203 cars containing 10,129,764 tons, estimated to have brought at the ovens $20,259,528. The shipments for 1899 were 20 per cent above those of 1898 which had been the record year. The year closed with a total of 19,689 ovens in the Connellsville region as compared with 18,463 at the close of 1898. It is estimated that the output for 1900 will exceed 11,000,000 tons, but with all the reported activity in opening new mines and in building new ovens it is believed that the operations of 1900 will not show enough additional capacity available to be a marked factor.

T. P. KELLY & Co., foundry supplies, have moved their Chicago branch from 121 N. Ada st., where they have been located for the past 20 years, to 34 Robert st., where more commodious quarters necessary for the increased business have been secured.

The new 8-inch rolling mill at the American Iron & Steel Mfg. Co.'s west works, at Lebanon, Pa., was placed in operation last week.

THE CHEMIST AND THE FOUNDRY.

TO THE EDITOR:

I have read with a great deal of interest the many valuable papers on chemistry and foundry practice, published in *The Iron Trade Review* in the past few years. I have also visited many foundries and learned the opinions of many practical foundrymen on the application of chemistry in general foundry practice. While all are willing to adopt anything that will give greater certainty in the production of good castings, many are skeptical of the results that may be obtained from mixing iron by chemical analysis, this being the branch of foundry practice for which chemistry has been most strongly advocated and to which it has been most applied. This sentiment I have found to be due largely to the experience of foundrymen, who, having employed chemists and made a complete failure of mixing irons by analysis, have been compelled to go back to the old method of mixing by fracture and practical experience, or go out of business. Quite a number of firms have become so infatuated with chemical analysis that they have failed in business through the heavy losses entailed by mixing iron in this way. Among them was one of the oldest and largest car wheel works in the country. This firm mixed its iron by the analysis of its chemist for a number of years I was informed by their foundry superintendent that they frequently broke up an entire cast of 300 wheels, after they were taken out of the annealing pits, for the reason that the mixture of iron did not give the required strength and chill. These losses together with many wheels condemned after they had been put in use, compelled the firm to go into the hands of a receiver, and after reorganization the same practice placed them in a receiver's hands the second time, and finally out of business.

The failure of the application of chemistry to foundry practice in cases investigated does not appear to have been due to chemistry, but to the chemists, who in making cases have shown themselves wholly incompetent to do the work required of them. At one large radiator works visited, a complete laboratory had been fitted out at great expense and a chemist employed, who, when a determination was wanted at once would say: "The sky is too blue today," or "the clouds are too low," "the atmosphere is too clear," or "too heavy," etc.; and the laboratory was abandoned as a failure. At another large foundry where failure was reported, the chemist was found to have made accurate determinations by submitting samples to other chemists. But after repeated failures to obtain desired results from his determinations it was found that he could not add up a column of ten figures correctly, and could not figure out the results of his determination and apply them to various irons to be used in a mixture for a heat.

In other cases where failure were reported, the chemists made the excuse that the sample was dirty, was too fine or too coarse, was not taken from the right part of a pig, the pig was not a fair sample of the iron, etc. To overcome these excuses for failure, pigs have been carefully selected, planed and polished, to remove sand and dirt and samples taken from different parts of the pig, with no better results in the mixture, this experience being followed by the excuse that the reagent was not good, the apparatus was not of the latest improved pattern, etc. In fact, the foundry chemist in many cases, appears to have taken the place of the old professional melter, who enveloped the management of the cupola in mystery, seldom melted a good heat and for the many very bad ones melted always had an excuse which his employer was bound to accept, for the cupola was a mysterious foundry apparatus which no one but the old melter knew anything about.

These excuse-making melters were so accurately described in my work, "The Founding of Old Metals," published in 1877, that they have almost ceased to exist, and foundrymen are not likely to replace them by excuse-making chemists. If the chemist is ever to gain a foothold in the foundry, he will have to do it by the results of his determinations, and not by making excuses for his failures.

A man to be a foundry chemist must be thoroughly up-to-date, capable of making in the shortest possible time an accurate analysis of all the materials employed in founding, such as metals, coke coal, fluxes, fire brick, clay, sand facing, etc. After making an analysis of these various substances

and determining their component elements, he must be able to state positively if the material is suitable for the purpose for which it is to be employed in the art of founding. For example: After making a determination of the carbon, silicon, sulphur, phosphorus, magnesia, etc., in irons submitted for analysis, he must be able to state if any one of the irons when remelted will possess all of the characteristics of an iron best suited for the work to be cast. If not, will a mixture of one or more of the irons produce an iron of the requisite quality and what per cent of each should be employed in the mixture. Does a coal or coke submitted, contain the requisite number of heat producing units, to do fast and economical melting? Does it contain elements detrimental to iron, in sufficient quantities to affect unfavorably the quality of iron melted with it? Can such deterioration be overcome by changes in the mixture of iron if other fuel is not obtainable? Has a fire brick the necessary refractory properties to make a good cupola lining for the grade of fuel, flux and iron melted, or would another quality of brick last twice as long under the same conditions? Is a given clay suitable for cupola daubing, ladle lining, loam cores, etc.? Has a sand the requisite properties of a good molding sand? Will it give a smooth surface in light work, or withstand the action of a large body of molten iron in heavy work? Will a facing wash before the molten iron become damp so rapidly that it can not be slicked or the pattern returned, produce a smooth casting, harden the iron, etc.? Is the limestone or other material suitable for a cupola flux, will it keep the cupola working open and full throughout a heat, clean and improve the quality of iron, protect the cupola lining, or cause it to burn out more rapidly?

All these points—and many more—must be determined by the foundryman before he can produce first-class castings. At the present time they are determined by what is known to the practical foundryman as experimental or trial foundry practice, and to those unfamiliar with the details of foundry work, as the "rule of thumb" foundry practice.

If the material used in forming a mold does not produce a perfect casting or the iron used does not possess the required degree of hardness, softeness or strength, the casting is condemned and broken up, and the cost of determining the suitability of foundry material is represented by the cost of these condemned castings, and the cost of the condemned material, which may remain on hand for years or be thrown in the dump. The loss on such material is no small matter in many cases, as we have frequently seen tons of condemned iron lie in the foundry yard for years, barrels of blacking stand around until the barrels fell to pieces and the blacking was thrown in the dump, and piles of molding sand and clay reach the same destination after repeated failures to use them successfully.

If the chemist can determine the suitability of these various materials for the purpose for which they are to be employed in founding, at a less cost and with more certainty than by the present method, then the foundryman wants the chemist. If he cannot, the foundryman has no use for him.

To do this, the chemist must have some practical knowledge of the art of founding to enable him to apply the knowledge he has obtained by his analysis, and produce in the casting the results indicated by his determination, and to overcome the prejudice or ignorance of the founding foreman, melter and molders. For instance, a melter from ignorance or habit may not make up his cupola in the best shape for melting. He may charge the fuel by counting the shovels, weigh the iron by counting the pigs and shovels of scrap, place too much, or too little fuel in the bed and charges, melt iron too high or too low in the cupola and with uneven temperature. From prejudice against the chemist, he may not weigh the iron accurately or use the proper per cent of different grades in the mixtures; mix the iron in charging unevenly, etc. Pig and scrap when not properly charged, and the cupola tapped close, will give all pig in one ladle and all scrap in another. High silicon and low silicon irons, hard and soft irons may be drawn in the same way. Iron melted too high in the cupola is hardened and iron melted fast and slow hot and dull, in the same heat is not of the same degree of hardness, softness, or strength throughout the heat.

It will thus be seen that a chemist who has no practical knowledge of the management of the cupola, is entirely at the mercy of a poor or prejudiced melter, and can never be certain of the results of a mixture made according to his determination. To overcome this difficulty and make himself master of the situation, the chemist must be a thorough practical melter, capable of chipping out and daubing up a cupola in the best possible shape for melting, and make up the cupola for a heat. He should know the exact amount of fuel required for the bed and each charge, and the exact amount of iron to be melted on the bed and each charge of fuel; when the bed is properly burned for charging; the mixing of irons in charges to produce an even mixture when melted; and to melt an equal amount of iron of an even temperature every minute from the beginning to the end of the heat. It is not necessary that the chemist should do all his work, but he should be able to instruct the melter how to do the work, have full charge of him, and see that the work is corrrectly done, and the best possible results in melting obtained from the cupola.

He must also be able to defend his iron in the castings, for there is no mechanic on earth that can give more plausible excuses for bad workmanship, than the poor molder. When a casting is condemned and broken up, the chemist must be able to say from the fracture whether the iron is hard or soft. If hardness in a casting is due to the iron, wet molding sand, hard ramming, finishing the mold with a swab, strong facing, etc. If there is dirt in the casting, was it in the iron and could not be removed, or did it come from a dirty mold, careless skimming, bad pouring, etc.? He must be able to defend all material he has analyzed and recommended for use in the foundry in the same manner.

Where is the foundry chemist to obtain this practical knowledge? There are no colleges that we know of, in which foundry practice is taught, in connection with a course in chemistry. There are no mechanical schools in which chemistry is taught, in connection with a practical foundry course. The chemist, after he has obtained his diploma from a college or other school, may take a course in foundry practice in one of the mechanical schools, but so far as we have been able to learn, this course is not especially adapted to the training of chemists in foundry practice, and the would-be foundry chemist after receiving his diploma in chemistry has been compelled to get his practical knowledge in the foundry at which he is employed.

Where the chemist has been a practical man as well as a chemist and the foundryman has been a practical foundryman and given the chemist his hearty support, the chemist has been able to gain this practical knowledge and make foundry chemistry a success. But in cases where the chemist was not a practical man or the foundryman did not give him his hearty support, foundry chemistry has been a failure, from lack of proper training of the chemist; and up to the present time foundrymen have derived more benefit from the blast furnace chemist than from the foundry chemist. This should not be the case and would not be so if schools were established to give the foundry chemist a proper training for the work to be done. It seems to me that the trade or mechanical schools might well take up this branch of instruction, and give a practical course in foundry chemistry that will at least give the student some idea of what is required of him, and how to gain this practical knowledge when employed in a foundry.

EDWARD KIRK.

Philadelphia, Jan. 12, 1900.

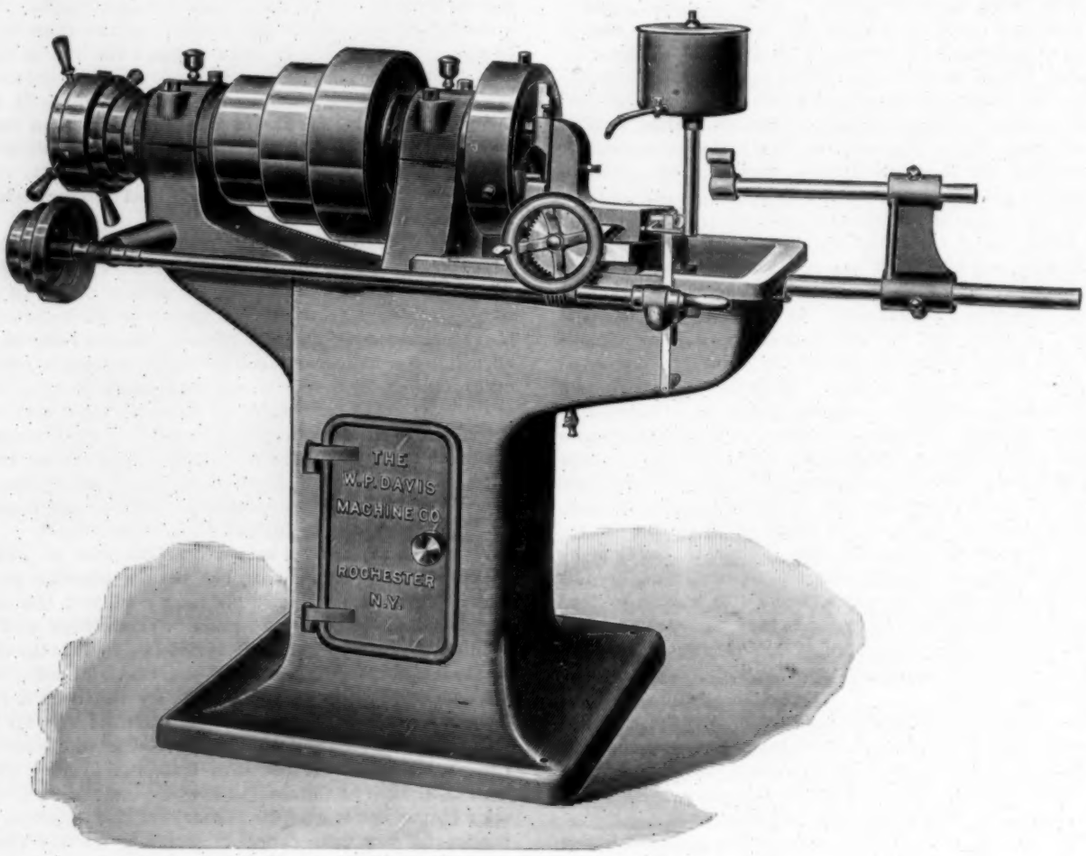
THE Diamond State Steel Co., capital $3,000,000, has leased the plant of the Diamond State Iron Co., at the rate of 4 per cent per annum on the capital stock of the iron company, which is $1,000,000, making an annual rental of $40,000. In addition to the operating of the plant the company is building an open-hearth steel plant, for both basic and acid steel, having a daily capacity of 500 tons, this in addition to the product of the Diamond State Iron Co. The plant will be in operation about the latter part of February. H. C. Wallace is president; L. A. Bower, vice-president; W. E. Boughton, treasurer; W. H. Wallace, secretary. The works and main office are in Wilmington, Del.

The weldless tube works of Ellwood, Pa., are to be removed to Greenville, Pa. This is the third large plant the Greenville works have absorbed.

THREE-INCH CUTTING OFF MACHINE.

An improved 3-inch cutting off machine manufactured by the W. P. Davis Machine Co., of Rochester, N. Y., has a number of points whose value has been demonstrated in use. The spindle bearings are large and long, and the cones are of ample width and diameter. There are two strong chucks, one on each end of the spindle. A special feature is the tool-post or holder, which is of unusual strength and stiffness, and is provided with two lateral adjusting screws, so that after once setting the tool true and square, it can be removed for grinding and can be replaced in its original position without loss of time and without changing its distance from its length gauge. There is an automatic throw-off, which stops the feed when the piece is cut off.

The length of the gauge is provided with a finger at its forward end, which can be thrown over, after gauging the length, to prevent cramping the tool as the piece drops off. The countershaft has two changes of speed, making with the



THREE-INCH CUTTING OFF MACHINE.

changes on the cone six different speeds for the main spindle. The pulleys on the countershaft are driven by a simple and efficient clutch, so that by an instantaneous movement of the lever the speed may be accelerated as the tool approaches the center. Three-inch round stock and under can be cut on this machine. Friction pulleys on the countershaft are 12 inches in diameter, 4 inches face, and should run 70 and 100 turns a minute.

The Federal Steel Co.

Speaking of the steel situation, President E. H. Gary said recently that a better year is expected in 1900 than last year. The demand for pig iron is still in excess of the supply, while it is almost impossible to obtain coke at any price. His company would like to get more coke, although it now has a supply of about 125,000 tons per month. The Federal Steel Co.'s ovens have an output of about 80,000 tons per month, which will be doubled by next May. Contracts have been made to sell nearly 3,000,000 tons of ore, or about the entire output of the Minnesota Iron Co., for the next season, beginning in May. Part of this ore will be used by the Illinois Steel Co.

MODERN STEEL RAIL ROLLING.

In discussing the American Society steel rail section an engineer writes the *Railroad Gazette* in part as follows, making a text of recent comment by that journal:

The reasons given by you why the society section should be better than the old standards are sound and good, and there occur to me two other reasons which, perhaps, are just as good: First, The rail is certainly much stronger than most, if not all, of the old standards, and better able to resist the effects of heavy, rapidly moving locomotives and cars. I think the trouble arising from surface-bent rails will be entirely eliminated if the track surface is fairly well kept up, and that the number of broken rails will be greatly reduced. The second reason why the Society rail should be better is one that, from an operating standpoint, is of great importance. There is no doubt but that the broad flat head of the American Society pattern will add materially to the tractive power of locomotives and permit an appreciable increase in train tonnage. The importance of this ability to increase tonnage without increasing the size and weight of the locomotive every transportation officer knows.

I am surprised at what you say in regard to a reaction from the use of the heavier pattern rails, and believe that if this is so it is only temporary and limited in extent. So far as I know of railroads in the Middle West they are not reducing their sections, but as rapidly as possible are substituting rails from 80 to 90 pounds per yard for the lighter patterns. I do not know very much about the 100-pound sections, but belive if there has been any dissatisfaction with it, it is partly the fault of the mills in not properly rolling it and partly the fault of a section which cannot be properly handled by the mill. If the Society pattern is used and the mill work properly done, I believe the 100-pound rail will prove just as good and serviceable as the lighter sections.

With the very heavy locomotives, some of them having as high as 193,000 pounds on the drivers, and the 100,000 pound capacity freight cars, and at the high speed which it is now necessary to run almost all classes of freight, the heavy rail has come to stay, and railroads instead of going back to lighter sections must replace all their light rails as fast as

possible. The light rail section might answer the purpose if our railroads were constructed on a permanent way, but as they are not, we must at least partially overcome the defects of roadbed by the use of heavy rails which will be capable of distributing the load over several ties without injury or liability to surface bending.

As to the quality of the rails now being rolled and ways and means for improving it, a great deal more could be said than would be permissible in an article of this kind. There is no question but that the rails turned out of the mills today are inferior to those of fifteen or twenty years ago. On the other hand, I do not think it fair to lay all the blame on the mills because the rails now rolled will not carry so great a tonnage as the rails rolled in 1880. The rails laid twenty years ago were subjected to light power and cars, and few and slow trains as compared with today. In 1880 there were few locomotives with over 100,000 pounds on the drivers, the cars were 40,000 pounds capacity or less, the number of trains, light as they were, was much smaller than now, and the speed about one-half as great. The effects of these trains and movements on the rail, when new, was different from the effect now, and without doubt is responsible for a considerable part of better wearing qualities of the rails of long ago. The proposition confronts us, however, that the rails of 1899 are inferior to those of 1880, when from the nature of the burden imposed on them they should be made better, and the great question with the railroads today is how to procure a better rail than they are getting.

I am quite of your opinion that there is more in the physical treatment of the rail than in its chemistry. The best American rails seem to have been made between 1876 and 1882, and at this time there was very little uniformity in the chemical analysis of Bessemer steel, yet the rail was uniformly good, showing conclusively that it was not the chemistry, but the physical treatment that made the good rail.

At that time the usual practice in making rails was about as follows: The pig from the blast furnaces was remelted in cupolas and blown in converters, much slower and in smaller quantites than now. The ingots were allowed to cool, and charged into horizontal furnaces, where they were slowly reheated, and were bloomed into blooms in thirteen passes through the rolls. These blooms were allowed to cool and then again slowly reheated and rolled into rails by thirteen passes in a train of rolls running about 400 feet per minute.

In the modern mill practice the iron, when reduced in the blast furnace, instead of being molded into pigs, cooled and reheated, is run fluid from the furnace to a mixer and passes, still in a fluid state, into the converter, where it is blown hard and fast. The steel from the converter is cast into ingots, charged into a heating furnace and held there until ready for blooming. The ingots are bloomed into blooms in eleven passes through the rolls; the blooms while still hot, are again charged into the heating furnace and are rolled into rails with nine passes in a train of rolls running 900 feet per minute.

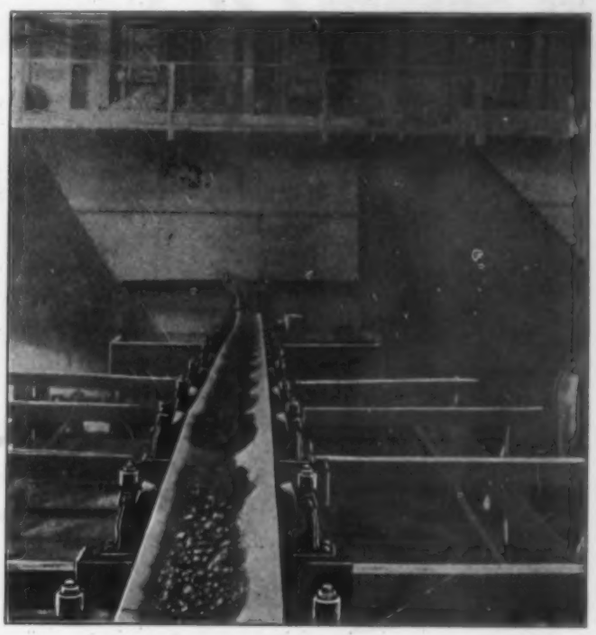
Keeping the metal constantly hot, never allowing it to cool or come to rest molecularly may not make any difference in the quality; some engineers claim that it does and others that it does not. The rapidly moving rolls reducing the ingot to the bloom much faster and with fewer passes than in the old rails may not affect the quality of the rail, as the metal is handled at a higher temperature while it is more plastic than formerly. The principal fault with the modern mill practice lies in the fact that with fewer passes and faster speed of train, the rail is finished too hot. In the present practice the finishing pass is reached while the metal is still at a temperature of from 2,000 degrees to 2,200 degrees F., while formerly it was finished at a temperature of from 1,400 degrees to 1,600 degrees F.

If steel is allowed to cool wthout working it will be coarsely crystalline in structure, while if it is constantly worked from the time it becomes plastic at about 2,600 degrees F., until it cools to a temperature of about 1,300 degrees F., (after which it becomes too solid to work without injury), the structure will be finely granular throughout.

I believe if the users of steel rail will not only provide the best known chemical specifications for the metal but also specify that it shall be constantly worked between the temperatures of 2,600 degrees and 1,300 degrees F., the result will be a good and satisfactory rail, even better than that of 1880, inasmuch as the American Society pattern is better than the old standards, and that this good rail can be obtained without difficulty in 100-pound sections.

JEFFREY CENTURY BELT CONVEYOR.

The Jeffrey Century belt conveyor as used in the plant of the De La Mar Mercur mines of Mercur, Utah, is shown in the illustration below. This is one of several conveyors of various dimensions used by this company for handling ore. This conveyor is especially designed for the handling of all abrasive material, which should be carried rather than scraped, to avoid excessive wear. The principal features of the Century belt conveyor are these: A special grade of rubber belting is used, having its carrying side re-enforced with an extra thickness of rubber of a special composition, which effectually resists the cutting tendency of the material and greatly prolongs the life of the belt. An ordinary rubber belt would not answer for this class of work. The carrying idlers, which consist of special stands and pulleys, the latter running on self-lubricating bearings, require oiling only at long intervals. The pulleys are set so as to give the belt the shape of a trough, thus concentrating the material in the center of the belt and keeping it from spilling over the sides.



JEFFREY CENTURY BELT CONVEYOR.

These conveyors are manufactured by the Jeffrey Mfg. Co., Columbus, O., in all lengths and sizes for various duties, and are described in detail in the company's catalogue.

A Puddling Rate of $5.75.

By the bi-monthly settlement of the wage scale at Youngstown last week, the puddling rate for January and February is made $5.75, the highest rate paid for a long time. A peculiar feature of the present wage scale is that beyond 1.6-cent bar iron, for which the rate is $5 50, the rate advances by only 12½ cents for each tenth cent advance in bar iron. The present rate of $5.75, therefore, is based on 1⅝ cent bar iron, and the average price of shipments of common bars was therefore at this rate or higher in the months of November and December last year. From the beginning of the present scale year, July 1, 1899, the base rate of $5, as against $4, the base rate of the previous year, was paid until Nov. 1, when an advance of 50 cents went into effect, based on 1.6-cent bar iron in the months of September and October, so that in two months the average price of shipments of bar iron increased by two-tenths of a cent, but puddling wages advanced only 25 cents.

MACHINE FOR GRINDING CHILLED ROLLS.

A machine devised by A. L. Kelly, of Wheeling, W. Va., and manufactured by the Mesta Machine Co., of Pittsburg, is shown in the illustrations below. It will grind a straight roll or a concave roll and its special feature is the ease with which it may be adjusted to the work. In Fig. 1 a view is given of the machine, there being a single bed plate, and pivotally mounted between its front and rear sections a platform for supporting the roll to be ground. A sliding carriage on the rear upright section of the bed plate has a grinder frame adjustably mounted in it. The grinder is connected by means of pulleys to shafting, and water is conveyed to the grinder as shown. The platform may be adjusted in an inclined position, accommodating the roll to the work to be done, by means of set screws at the ends of the platform, as shown in Fig. 2. The axis of the grinder is set at an angle to that of the roll, and means are provided for feeding the grinder longitudinally of the roll. Cushions are provided for preventing shock when the carriage reaches the end of the movement. Means are also provided for simultaneously rotating the roll and grinder and feeding the carriage longitudinally of the roll.

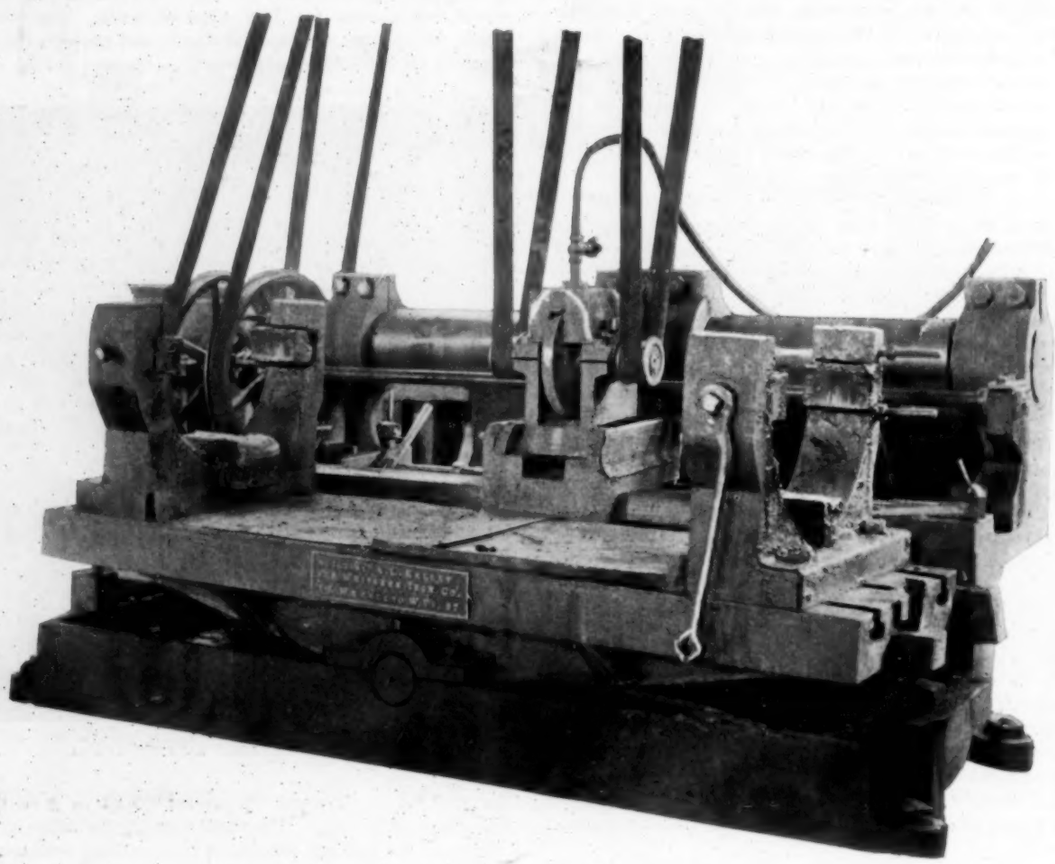


FIG. 1.—MACHINE FOR GRINDING CHILL ROLLS.

The reproduction in Fig. 1 is from a photograph of a machine that has been in use at the Whitaker Iron Works, Wheeling, for the past two years. More recently the machine has been built for use in the Mesta Machine Co.'s plant.

The Ironton, O., *Register* gives the output of the blast furnaces of Lawrence County in 1899—a total of 183,436 tons, against 102,577 tons in 1898. This, with the Ironton and Big Etna furnaces active only a part of the year. By furnaces the figures for 1899 stand: Marting Iron & Steel, 38,000 tons; Sarah, 39,000 tons; Hecla, 12,500 tons; Vesuvius, 1,600 tons; Belfont, 35,750 tons; Hamilton, 37,500 tons; Olive, 2,000 tons; Lawrence, 12,000 tons; Union Iron Co., 5,086 tons. The nail product of the Ironton was also heavy. The Kelly Nail & Iron Co. made 275,000 kegs of wire and cut nails, and the Belfont mills, 210,460 kegs of iron and steel nails. In 1898 the total output of both mills was 227,990. In 1899 it was 485,460 kegs.

RECEIVED FROM THE TRADE.

The general catalogue of the Mossburg & Granville Mfg. Co., of Providence, R. I., is issued under the title "A Model Plant and What It Produces." It contains 230 pages of illustration, description and data as to sizes and capacities of the machines shown and is bound in flexible red leather. The greater part of the volume is given up to descriptions of the company's presses, rolling mills, roller bearings and wire drawing machinery. In addition considerable space is given to its special machinery, including its sensitive drill, semi-universal milling machine, rotary shears, cam-cutting machine, lap lathe, countershafts, roller bearing hanger, revolution counters, punches, dies, etc. The company's power and automatic drop presses are made of capacities ranging fro 50 pmounds to 100 tons pressing weight. Its drop hammers give an effective blow ranging from 50 pounds to 1,200 pounds. The Mossberg & Granville roller bearings are for rolls of all sizes up to 20 inches diameter and 36-inch face, with bearings from 20 inches long down to the finest machinery for jeweler's work. Thrust roller bearings are manufactured for the heaviest work, such as that required for elevators and bridges. The rolling mills of the company are chiefly those designed for reducing and finishing brass, copper, steel, silver and gold, and in wire drawing machinery there is a great variety of adaptations of its product. A large steel wire drawing plant is now under erection. The rolling mills mentioned have the Mossberg roller bearing on the roll journals and employ cut gears for all driving mechanism. The application of roller bearings, it is stated, permits of running these mills at twice the ordinary speed and with less than one half the driving power. With friction on the roll journals largely eliminated, so that there is no heating of the rolls, a considerable reduction is made possible in the size of the driving gears. Supplementary to the general catalogue three small pamphlets are issued by the company, relating respectively to the Mossberg roller bearing, the company's drop presses, and the Granville automatic typewriter. The Mossberg & Granville Mfg. Co. entered new quarters on Dec. 1, 1896, and now occupies three floors in a great build-

ing, its manufacturing departments taking up three acres of floor space. The present working force is 250 men, and is very fully employed, with excellent outlook for trade in the coming year.

Two catalogues of the Rand Drill Co., both 6x9 inches, are valuable for the information they contain concerning the development of two important lines of mechanical progress. The one relates to rock drills, the other to air compressors. Both contain views of the present extensive works of the company at Tarrytown-on-Hudson, N. Y., and Sherbooke, Que., and the old shop in New York City in which the Rand Drill Co. began business and which is used still for experimental work. The compressor catalogue, which contains 135 pages, is profusely illustrated, the cuts showing how the design of the earliest compressors, whose field was almost entirely mine and tunnel work, has been changed, as the uses of compressed air have broadened and multiplied. The perfection now obtained is entirely comparable to that of the steam engine. The second catalogue, which deals with Rand drills and drill mountings, has an introductory historical sketch by President Addison C. Rand tracing the successive stages in the advance of the rock drill to its present perfection, dating back to the employment of steam drills as known today in the excavation of the Hoosac Tunnel. The first to make a drill in which the drill steel was the extension of the piston rod of a reciprocating engine was James W. Fowle, of Boston. In addition to the Little Giant drill, the company manufactures the Slugger, the New Slugger, and the Little Terror styles, besides special patterns.

Recently received trade calendars that merit mention in addition to those heretofore noticed are from the Cherry Valley Iron Works, Leetonia, O.; Youngstown (O.) Iron & Steel Roofing Co.; and Acorn Brass Work, Chicago. The Springfield Machine Tool Co., Springfield, O., sends out a thumb and finger calendar, in celluloid, indicating noteworthy days in 1900 and interleaved with wax paper for postage stamps. S. H. Pitkin, general manager of the Webster, Camp & Lane Machine Co., Akron, O., sends to his customers a handsome morocco card case as a reminder for 1900.

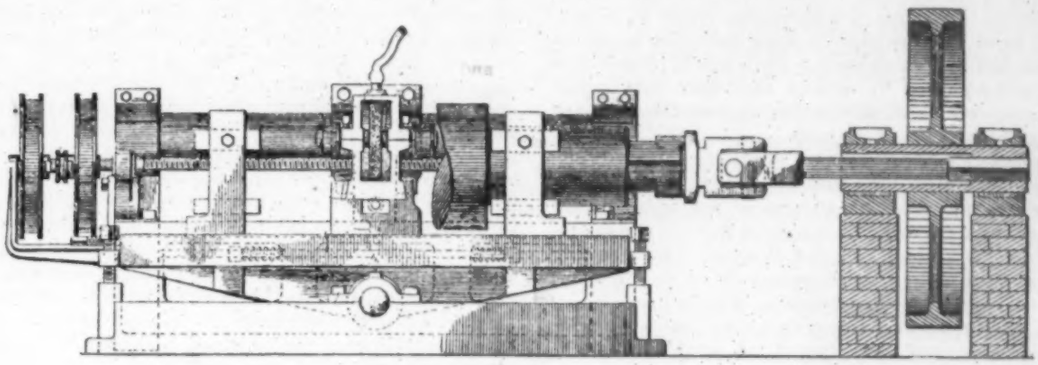
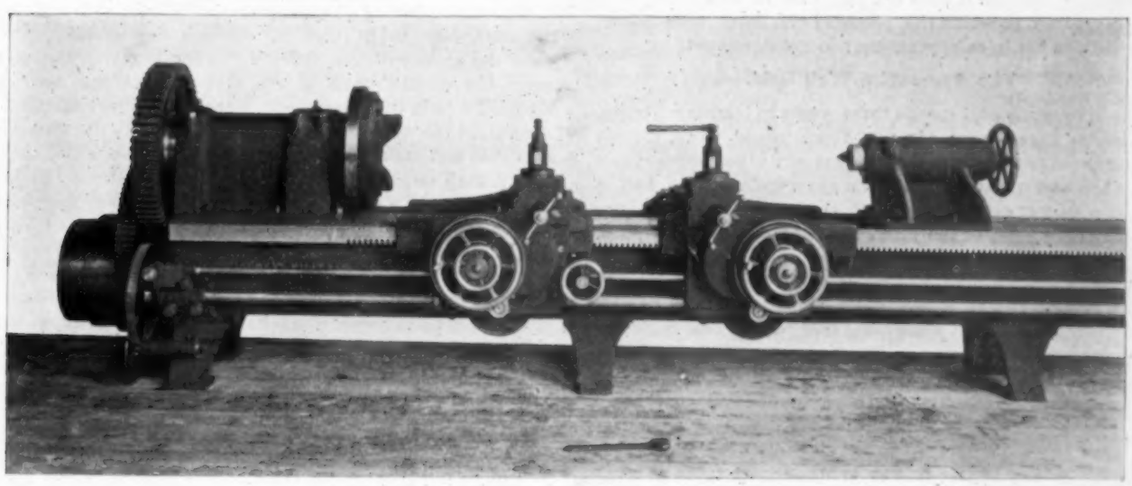


FIG. 2.—SECTIONAL ELEVATION OF ROLL-GRINDING MACHINE.

SINGLE LOCOMOTIVE AND CAR AXLE LATHE.

For turning axles up to 11 inches in diameter, a heavy lathe is manufactured by Bement, Miles & Co., of Philadelphia. The length of bed is 13 feet 3 inches, for axles 8 feet long, but it can be increased if required. Power is derived from a 24-inch cone, having three changes for a 5-inch belt, multiplied thirty times through heavy cut gearing to spindle. An electric motor for driving may be used as well. The spindle is a hollow steel casting, 8 inches in diameter, enlarged at the end into a face plate, to which a double adjustable driver is attached. Carriages are made right and left handed, to bring cutting tools nearer together, and may be provided with a former attachment. Their movement on the bed is by hand wheels, through cut gearing to rack. The tool slides, which are adjustable by crank handles and steel screws, have raised edges for draining the lubricant, and are made large enough to cover entirely their bearings. If only one carriage is desired, it will have the tool slide made central.



SINGLE LOCOMOTIVE AND CAR AXLE LATHE.

The feeds are infinitesimally variable from 1-18-inch to ½-inch per revolution, through cut gears, splined shaft and cut steel rack, and may be instantly engaged, or disengaged, by hand wheels, operating friction discs. The degree of feed is controlled by the operator from the carriage, while the machine is running. The sliding head is adjustable the entire length of bed, and has two taper shoes for taking up wear and preserving the alignment. The sliding spindle is of forged steel, 5 inches in diameter, held rigidly by split bearing and clamping bolt. The center line of the axle is brought forward of the center of the bed, to afford easy access to the work.

MODERN APPRENTICESHIP CONDITIONS.*

The Training of the Schools and That of the Shops.

BY PROF. JOHN E. SWEET, SYRACUSE, N. Y.

I appear before you this evening with a certain degree of saitsfaction and a certain degree of reluctance. With satisfaction because it is always a pleasure to talk over one's life experience and notions among those who have themselves had both experience and notions, and I came here with reluctance because you are likely to expect more of one who comes so far than you are of one another. While I have had some experience of talking to students, this addressing people on a subject about which they are likely to know more than myself, is rather new, and one can no more make a speech (unless he is endowed with a gift for it) without experience than a boy can use a chipping chisel, drive a shoe peg, or shove a jack plane, until he has learned the trade.

This learning a trade, or, in other words, the apprenticeship feature of mechanical industries, is a fitting beginning to what I have to say. We have all been or are apprentices, I take it, and when the oldest of us were so favored, the system differed from the present one, and however much we may desire to go back to the good old system, it cannot be done. We old men were all good apprentices. I know I was a real good one, and for no other reason than that I had a first-rate boss. As the boss and I constituted the whole force, aside from the discrepancy in age, knowledge and position, we were chums. When he set me at a job he not only told me what to do, but how to do it, and if there was a reason he told me why. Who could not learn under such circumstances? With our present methods there is no such opportunity. It is not the employers' fault, though the apprentices may think we are rather mean, and if the apprentices of today are not very good apprentices it is not their fault; conditions have changed; no one is to blame for it. In the old days there were boys who wanted to learn trades and employers who wanted apprentices, because they could make them pay. They would make good workmen of them in the first years and get a profit out of them in the last. But now employers do not care for apprentices, because it does not pay, and in this there is a simple problem in which the parents (who have sons whom they wish to put in as apprentices) do not figure out.

The Apprentice Well Paid.

The apprentice who spends three years in learning a trade, and learns it, gets more for this three years' work, though he works for nothing, than he will get any other three years of his life as a workman. Let him get a dollar and a half a day as a laborer or two and a half at his trade, the difference will be $300 a year, or the interest on $5,000 or $6,000 capital, and the trade is capital he cannot lose.

In the old days a machine shop could be run at double the men's wages—that is, if the average wages were $1.50, it would pay to charge $3 a day—but that was when building, power and machines cost but little money. With machines costing from $500 to $5,000 to the man, it cannot be done at so low a figure. If the cost of the apprentice is 75 cents a day, and the expense of running the machine is $2.50 a day, the boy's product must sell for $4 in addition to the cost of material, to keep even. If a $2 50 man can do twice as much as a boy his product will at the same rate bring $8, besides cost of material; so on this basis the boy must either do more than half as much as the man, work for less, or the employer cannot afford to have him—in fact, half the time he cannot afford to have him for nothing; and that is not the worst of it. the apprentice often fares worse than the employers; he gets no instruction; he gets a chance to work; he gets a chance to make different pieces of something, but that of only one kind of product, and of the product itself he learns but little. This is one phase of the case, and a rather common one, but there are others. There are yet, even with these conditions, a large number of applicants for apprenticeship positions who cannot get places even at comparatively no pay; and in certain trades where both the boy and master are willing, the trades-union rules, according to their own statement, prevent.

As shown, the apprenticeship system of old is only in rare cases possible now, and the question must force itself upon our people as to what is to take its place. If limited by the circumstances and the unions our ranks must be filled from abroad or trade schools must be established. I do not mean training schools, which are useful enough in their way, but trade schools pure and simple. Owing to the fact that the opinion is universal among mechanics, that a boy cannot learn a trade at school, I wish to define what I mean by a trade school; that is, a school where the object is to give a boy a chance to learn a trade, not a school of school teachers out of college, or school teachers that are graduates of technical schools; not an educational institution with machine shop attachments, but just shops, with machines and foremen and workmen, and work of all kinds going on to be sold for what it will bring. Instead of the chance the old apprentices had, I would have the boy not only have the chance of the old apprentices for doing all kinds of work, but would also give him all kinds of tools to work with, and all kinds of machines to build, which the old apprentices had not; and I would do better by him than that—he need work but eight hours instead of 12 or 14, and the rest of the time, after seeing that he knew how to read and write and spell, he should be taught enough drawing and machine shop mathematics to calculate anything he might need, and enough of the principals of mechanics as would be necessary to keep him from fooling away time on perpetual motion and like impossibilities, and, too, he should be trained to make what he did make a work of art.

Trade Schools and Their Field.

The question will at once come up: Can such a school be made self-supporting? No, it is not at all likely that it can. Some will think, after the shops are built, machine and power put in, that certainly the work turned out ought to sell for as much as the material cost. Yes, it should do this; but there is coal to buy, foremen and instructors to pay; and such a school, excepting by the greatest economy and genius, cannot be self-sustaining. Then the question naturally arises, How is it possible to establish such schools? and the reply is, exactly in the same way that all schools and colleges are established and maintained.

The state (that is, the people) establishes and maintains schools. Not that it (that is, we) has any moral right to take the money of the rich to pay for the training of the poor, but on the basis of the arrangement that we have adopted a form of government wherein we agree to abide by the will of the majority, so, as the majority say the state shall establish and maintain schools, it has the same right to say that it shall establish and maintain schools to train the poor man's son to be a shoemaker, as it has the rich or poor man's son or daugther to be a scholar, a doctor or a teacher, and it has already established special schools for teachers and doctors. It is true that doctors, while people get sick, and teachers to maintain schools are necessary, so, too, while we live in this climate we must have food and clothing, boots and hats, houses and tools, plows and fuel, and if we die (which we can do even without a doctor) crematories or coffins; and we need to know how to make all of these things before we need to know how to read or write, spell or cipher, and much more so before we need to study any of the higher branches.

As all children with present opportunities have the chance to gain the rudiments of an education, the book part of the true trade school needs bear but an insignificant position. I know this sentiment will meet with universal disapproval, but let us argue it to the end. Are not the boys and girls (for the girls are as much entitled to the benefits of a trade as the boys)—are not the boys and girls we are talking about to learn trades to follow through life, and trades at which they expect to make a life business? If so, then what is the education or training that will be of most use to them? Certainly it is of far more use to the shoemaker, as a shoemaker, to know the difference between a good piece of leather and a poor one, than to know how to read. It is of far more use to the horseshoer to know how to fit a horseshoe than to know how to spell, and of infinitely more use to the carpenter to know how to file a saw than to know how to write, and yet thousands of our carpenters know how to read, write and spell to every ten who can file a saw decently well,

*From an address before manufacturers and mechanics of Rochester, N. Y.

and one defect in their education arises from the fact that they are taught to be proud of the fact that they can read, write and spell, and have passed in arithmetic, grammar, and geography, French or Latin, and not to be ashamed of the fact, as they should be, that they cannot file a saw or build a winding stairway.

I would have the boys and girls who pass through trade schools know both the trade and all of a general knowledge that would do them any good, and I would not have the school spend one cent on them beyond that. If the boy had the ability to become an engineer, or the girl to become a teacher, or either had a desire for a scientific or liberal education, there are now plenty of schools for that without hampering the trade schools. But, you will say, will not all our mechanics and workmen be better mechanics and better workmen, and a great deal better citizens, to have a thorough education. Yes, if educated for his business as I propose, but not if educated through the regular course of our common schools and high schools, technical schools and colleges as now conducted. A thoroughly educated man in the ordinary sense, as a workman, is generally a nuisance to have around, but a man educated to his business, whatever it may be, is an honor to himself and his business, if he sticks to it and behaves himself.

The shoemaker who can take suitable leather and make an $8 pair of shoes out of it, where the cobbler could only make a pair that would be dear at $3, has a right to be proud of it, and when the scholars spend term upon term to learn to read and write, and speak indifferent French or German, worse than the German or French children, there is not a thing about it to be proud of, and, many times, the training in those directions gone through with by children in the high schools gives them little to be thankful for.

The man who is to spend his life as a workman is a poorer workman, a more unhappy man, and more often than otherwise a less desirable citizen, with a liberal or scientific education. With the liberal or scientific education he may get above the necessity of working for a living; but this all cannot do, and those who cannot should be trained to their calling and live happily.

Cost of Trade School Training.

About the cost of a training school: The entire cost of a plant for the ordinary machine shop, which is by far the most costly of any trade, will vary from $500 to $1,500 for every man employed; certainly I think it will not average over $1,000, and with the others make an average of a cost not to exceed $500 per student or apprentice, with a complete trade school outfit.

The absolute money value of our public schools in Syracuse per student is $56, and it is likely to average no less in other cities. The investment at Cornell University is from two to three thousand dollars for each student, besides, likely, there is paid from one hundred to one hundred and fifty thousand dollars per year in tuition fees, or an average of from fifty to seventy-five dollars for each student per annum. If the state would do as much to cover cost of instruction, and our wealthy men do as much to establish trade schools, of which there are none such as I speak of, as they do to establish colleges, of which there are so many, it is plain that it could be done, but it will not be until the people become imbued with the fact that such men as Edison and Bell, Westinghouse and Brush are of more use to this country and the world, are men that we have more reason to be proud of than of Longfellow and Bryant, or Emerson and Holmes, and I believe, from the fact that both Mr. Cornell and Mr. Sibley took so great an interest in the shop part of Sibley College, that had the money been invested in a trade school they would have been quite as well satisfied. The majority of our voting population are men who have to work for a living, and whose sons will have to go to work for a living, and now if they will profit by Herbert Spencer's saying, that "it is every man's duty first duty to provide for his own living, and the second to provide for the support of his family," they will do less grumbling ad see that some of the public money is spent to do their children the most good.

I have taken more time to argue this question than this division of my subject would justify, but am not through with the apprentice and h's opportunities yet. The apprentice wants to get all the money he can or get along the fastest he can, and the keynote of this is the keynote of life, whether an apprentice, a workman, a master, a railroad president, a college professor or an author. It is to work, and to work hard, and to everything one does in as good time as others do, and do the job as well as anyone can, and better than others if he can. And when you come to the money part, the question must not be how I can get the most money for what I do, but how can I earn more money?

It is true that the men who earn money do not always get it, but no more true than that manufacturers do not always get pay for all their product. And this is also equally true of the good apprentice, who is under paid andis far happier than the idler and slouch, whether over or underpaid. The apprentice must remember that he must be a good one or the employer cannot afford to have him around.

Pointed Questions for Employes.

The journeyman, like the apprentice, wants more pay, and there are two ways that he can try and get it. One is to earn it, and the other to strike. It is a common expression for the journeyman to say he is earning all he gets. If that is all he is doing, his employer cannot afford to have him around. If he is not earning more than twice what he gets it's the same thing. Some men are willing and anxious to do better, but do not know how; others want to do better, but the foreman or employer will not let them. In the latter case it is hopeless, except to change employers. In the other case the man may reasonably be asked a few questions, some of which likely never have occurred to him. Do you know how long it took you to do the last job you did? Have you taken any account of the wage cost of anything you are making right along? Have you kept track how much longer it takes you to do one job than another? Have you devised any better way to do jobs than the one first tried? Have you made any valuable suggestions to the foreman; have you given the apprentices the benefit of your experience? Have you stayed after quitting time, enough to more than make up the time you have lost? Have you ever offered to pay for the work you have spoiled, or even to lose your time wasted on the job? Do you spend an hour of an evening reading some trade paper? Do you always try, on a new kind of a job, just how big a cut and how high a speed your machine will stand? Do you know what speed your planer runs both ways, or what is the speed your lathe runs when the belt is on the different cones? When cutting long screws do you throw out the nut and run back by hand, or if the nut cannot be thrown out, do you throw the lathe in high speed to run back? Have you ever asked to have the work by the piece? Do you own your own tools, or depend on the shop? Do you ask for a heavy hammer when you have heavy chipping to do? Do you cut into a whole board or get a small piece? Do you look out to prevent waste of your employer's tools and materials? If you have done none of these things, what have you done to get better pay?

If you are looking forward to the time when you can get a foreman's position, it shows a laudable ambition, but the place is one of the most difficult, and, except for the additional pay, one of the most undesirable. The foreman is between two millstones, or, like one of the millstones itself, being dulled by the men and repicked by his employer every day. If you are already a foreman do you consider it your sole duty to make all you can for the company? Or do you consider that your position rests on finding a soft job for the president's wife's brother? Or do you consider that the men have rights which it is as much your business to see respected, and they liberally paid for what they do (if the company is prosperous), as it is your duty to see that the work is managed properly and to the interest of the concern?

If you are employed in a shop where no inventor or toolmaker is regularly employed, it may be that you have to take the place of inventor and designer, as well as formean; it's well to remember that you have rights as well as your employer, and that the employer has certain rights as well as you.

It is best to have an understanding in this regard; but the law in this, I believe, agrees pretty well with common fairness. The proprietor has a right to use in his business what you devise, and although inventors are always jealous of

their contrivances, you will find it much more to your interest to have your devices tried and used, though you get nothing for it, than to have them die. Then, too, a fellow is fortunate if he can get his devices tried at another man's expense. The more you improve the facilities the more you increase the product, and the better your chances for a better position.

In the case of a tool-maker, his inventions of tools for the firm are the property of the firm, or ought to be, as that is what he is paid for, and so, too, are such of the inventions of the superintendent as go to increase the product of the company.

One of the most difficult thnigs that a superintendent has to do, particularly if promoted from a lower position, is to keep from giving orders to the men direct, instead of through his foreman. Hard as this is for the superintendent, it is worse for the proprietor who has built up his business from a small beginning. When one has invented some machine or designed a new product, wrestled with the uncertainties of some precarious enterprise, made the thing go that would not go managed men and run a business, it is no easy task to surrender the control of the details into other hands, and is one of the pangs of success.

Some Dutles of Employers.

Having given the apprentice and workman some hints as to their duty to their employers, it cannot be out of place to question ourselves as to whether there are not duties we owe to our employes that we do not always think of. Do we deal with the workman as if he were a business man and consider that the few dollars that we pay him are as much his fortune as our holdings are ours? In any other transaction the other man has half the say. In our deal with our men is it not altogether too often that the man has nothing to say about it? We employers say, "We will pay you so much;" and that so much is the least we can get men for. Under these circumstances why should not the workman say, "Then I will do the smallest day's work that I can and keep the place." If we owe any man of prominence money, we will send him a check; if we owe the bank we will hustle around and go and pay it; but if we owe a workman, a farmer, or a laborer anything, he must come and get it. Are we making money by insisting upon our foreman cutting down wages to the lowest possible point and saving all we can, amassing a fortune to endow some college, or reversing the thing, as has been done, putting down another $30,000 Fellowship fund, coming home and saying to our foreman, "How many workers have you at work?" "Six hundred." "How much are you paying them a week?" "Six dollars." "Well, cut down their pay a dollar a week."

Do we pay our men all we can afford to because we pay the going wages? If we are making 25 per cent per year on our capital, are we sure the men get their share of it? If we are profiting by a patent, how much of the invention is our own, and how much did our men do about developing it that we have forgotten all about? Have we any old men who have grown gray in our service that are worth no more today than when they began, and if so, is it all their own fault or partly ours?

Classical Training for Engineers.

Since writing the part of this paper that relates to shop schools, there have appeared two papers that would, to a casual observer, tend to upset my argument. One entire number of the *American Machinist* was devoted to the apprenticeship question, and by their returns it is shown that one-half of the machine shops replying to their inquiry do take apprentices, and some say it pays them, others do it on principle; but the most say it's because it makes them the best men for their particular work, which is equivalent to saying that they are specialists and not all-around men. The other paper is a very able address by John H. Converse, before the students of the Lehigh Universtiy. The speaker advocated, in addition to the regular technical courses and workshop experience, that the students first obtain a classical education, that they not only be engineers but the peers of any men. For an engineer, I should favor the classical education as well as the workshop, if the student could afford it; but to admit that the classical education is necessary to make the engineer "the peer of other men," is conceding too much for the classical education; for it seems to me that Abraham Lincoln and General Grant needed no classical education to put a lustre on their glory; nor does Appleby, who invented the crowning gem of mechanics, a device to tie a knot in a string, which has been worth millions to the farmer; Bessemer, whose invention in commercial importance has been second only to the invention of Watt; Corliss, whose name in steam engineering will always be second to the great master, Watt, and Deering, in agricultural machinery; Fulton and the steamboat; Goodyear and rubber; Howe and the sewing machine; Jacquard and the looms; Krupp and guns; McCormack and the reaper; Nicholson and files; Perrin and the band saw; Roberts and standard gauges; Stephenson and the locomotive; Thurston, Unwin and Varney, as educators, and Watt, who did more for civilization and advancement of the world than any other man within the last 1,800 years. Do these or any of the other ten thousand mechanics who have done so much for mankind, need to stand in awe or surrender the proud position they have the right to hold, to the many educated who have done so little except to exalt their owe importance? In other words, is it necessary for the man who makes something of use out of useless material, and who has done something to benefit mankind and the world, to admit that the man who knows a lot which is of no use to anyone but himself is his superior? Is *to know* of more account than *to do*? Are the historians of more account than the men who make history?

I have referred to the making of our work works of art. Who has not seen a beautiful shoe, not beautiful by decoration, but beautiful in shape—was it not a work of art? Who has not seen beautifully dressed men and women—were not their dresses also the work of artists?

Is not the work of our carriage and cabinet makers, at their best, works of art, and is the carriage any the less a work of art because of its moving mechanism than is the cabinet at rest? Is the cabinet for bric-a-brac necessarily any more beautiful because of its utter uselessness than the sewing machine because it is useful? It may be so because the maker of the cabinet has no thought but of beauty, whereas the maker of the sewing machine thinks of the machine first, and looks afterwards; he has trained his mechanical faculties and neglected the artistic. The carriage designer trains both.

There is a strange feature in the inventor; when he has invented a machine he thinks he can design it, while it is an entirely different thing, and the ability to design is far more rare than that to invent. When anyone wants to build a house, he employs an architect to design for him; but the inventor or machinist designs his own machine, and they too often look as if "someone did it himself." This training of the designing faculty in our machinists has scarcely ever been thought of, and has never been attempted in workshop or school, and so little is known of it that but one in a hundred can tell the good design from the bad, and yet a perfect machine is a work of the highest art, for the artist is confined to the most rigid requirements; he is robbed of the use of all ornamentation, limited in space and material, and yet to one trained in the art, the machines of Sulzer, of Switzerland; Steinlen, of Alsace; Schneider, of France; Muir, of England, and Bement, or Richards, of this country, are things of beauty.

Center Blast and Life of Cupola Linings.

A correspondent recently stated that he had considerable trouble with a soft coke, which was easily crushed, the blast not penetrating the charge, but finding its way up the outside, causing the lining to burn away more than usual. Here it seems would be a good chance to use the center blast, in fact it has always seemed to me that one of the chief economies effected by the center blast would be the increased life of the cupola lining. Some people say that the lining cuts. That is a mistake. It melts. The blast itself does not wear it away. The blast increases the temperature, and in a cupola, methods of charging and subsequent rearrangement of the charge in settling, have much to do with the way the heat may be directed upon the lining of the cupola, and the consequent rapidity with which the lining melts away.—[The Foundry.

The Ajax Mfg. Co., of Cleveland, has increased its capital stock from $50,000 to $250,000.

OUTPUT OF BLAST FURNACES OF UNITED STATES.*

January 1, 1900.

Location of Furnaces.	Coke and Anthracite.					Charcoal.				
	Total No. of Stacks.	In Blast.		Out of Blast.		Total No. of Stacks.	In Blast.		Out of Blast.	
		Number.	Weekly capacity.	Number.	Weekly capacity.		Number.	Weekly capacity.	Number.	Weekly capacity.
New York	13	6	7154	7	3650	2	2	198	0	0
New Jersey	6	4	3002	2	1200	.....	.....	.....	.....	.....
Spiegel	2	2	450	0	0	.....	.....	.....	.....	.....
Pennsylvania:						13	2	115	11	550
Lehigh Valley	28	21	11213	7	2605	.....	.....	.....	.....	.....
Spiegel	1	1	110	0	0	.....	.....	.....	.....	.....
Schuylkill Valley	15	12	8440	3	1689	.....	.....	.....	.....	.....
Upper Susqu. Val.	5	4	3355	1	600	.....	.....	.....	.....	.....
Lower Susqu. Val.	10	10	6201	0	0	.....	.....	.....	.....	.....
Lebanon Valley	13	11	8440	2	734	.....	.....	.....	.....	.....
Pittsburgh	28	28	63975	0	0	.....	.....	.....	.....	.....
Spiegel	2	2	1421	0	0	.....	.....	.....	.....	.....
Shenango Valley	15	15	21999	0	0	.....	.....	.....	.....	.....
West'n Pennsylvania	19	14	16172	5	2120	.....	.....	.....	.....	.....
Spiegel	1	1	978	0	0	.....	.....	.....	.....	.....
Maryland	4	3	6031	1	250	4	1	90	3	440
Spiegel	1	1	270	0	0	.....	.....	.....	.....	.....
Wheeling District	10	10	14066	0	0	.....	.....	.....	.....	.....
Ohio:						8	2	163	6	395
Mahoning Valley	14	12	19468	2	2000	.....	.....	.....	.....	.....
Central & Northern	11	10	17438	1	700	.....	.....	.....	.....	.....
Hocking Valley	2	2	700	0	0	.....	.....	.....	.....	.....
Hanging Rock	12	10	5314	2	460	.....	.....	.....	.....	.....
Illinois	16	15	30270	1	900	.....	.....	.....	.....	.....
Spiegel	1	1	879	0	0	.....	.....	.....	.....	.....
Minnesota	1	1	850	0	0	.....	.....	.....	.....	.....
Wisconsin	4	4	3334	0	0	.....	.....	.....	.....	.....
Missouri	2	1	862	1	750	.....	.....	.....	.....	.....
Colorado	2	1	1100	1	1000	.....	.....	.....	.....	.....
Virginia	21	16	9835	5	2798	4	1	48	3	290
Kentucky	5	4	1510	1	600	3	0	0	3	200
Alabama	38	18	16254	20	13615	7	4	1255	3	240
Mich., Mo. and Wis.	.....	.....	.....	.....	.....	18	10	3971	6	2688
Tennessee	12	9	5388	3	2130	6	3	674	3	550
Georgia	2	0	0	2	960	3	1	435	2	300
North Carolina	2	1	352	1	400	.....	.....	.....	.....	.....
New England	.....	.....	.....	.....	.....	11	3	258	8	730
Texas	.....	.....	.....	.....	.....	4	1	260	3	740
Utah	.....	.....	.....	.....	.....	1	0	0	1	175
Oregon	.....	.....	.....	.....	.....	1	0	0	1	275
Totals	318	250	286729	69	40261	83	30	7457	53	7553

SUMMARY.

Fuel.	In Blast.						Out of Blast.			
	Number.			Weekly Capacity.			Number.		Weekly Capacity.	
		Month Previous.	Year Previous.		Month Previous.	Year Previous.		Month Previous.		Month Previous.
Charcoal	30	30	20	7,457	7,511	6,026	53	52	7,553	7,642
Coke and Anthracite	250	253	180	286,729	289,448	237,490	69	64	40,261	43,176
Total	280	283	200	294,186	296,959	243,516	122	116	47,814	50,818

*Condensed from the *Iron Age*.

Owing to the largely increased demands for its goods and the necessity for carrying a stock to meet the immediate demands, the Carborundum Co., of Niagara Falls, N. Y., has moved its Chicago branch from the Monadnock Block to 65 South Canal st. The company has made many friends since its Chicago branch has been open, largely through the efforts of its manager, Ed. J. Eames, whose experience and acquaintance with the trade has contributed in no small measure to the success of the business. The company manufactures carborundum, carbide of silicon, and carborundum wheels, cylinders, hones, slipstones, grains, powders, paper, cloth, etc.

The business of the Universal Construction Co. having been transferred to the Illinois Steel Co., it will be continued as the structural department of the Illinois Steel Co. under the immediate supervision of W. H. Pratt as manager, at North Works, 50 Wabansia ave., Chicago. Correspondence in regard to prices, specifications, orders, etc., for structural steel, and contracts for construction, should be addressed direct to Mr. Pratt, at the above address.

The minority stockholders of the Susquehanna Iron & Steel Co. are trying to prevent the sale of that company and of the New Haven Iron & Steel Co. to the Atlantic Iron & Steel Co., recently incorporated in New Jersey with $10,000,000 capital.

INDUSTRIAL SUMMARY.

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

New Buyers in the Market, and Some of Their Wants:—

Bids for furnishing boilers, dynamos, feeders, mines, wire accumulators, etc., for lighting plant for Melbourne, Victoria, will be opened March 1. Specifications and particulars may be obtained from the Agent-General for Victoria at 15 Victoria st., Westminster, London, Eng.

Madisonville (Ky.) Machine Works wants 100-pound second hand Bradley trip hammer, one drilling machine, one shaper, one round lathe, foundry tools, cupola, etc.

W. H. Gibbes & Co., Columbia, S. C., are in the market for second hand 4 to 6 h. p. hoisting engine with boiler comt plete, single or double drum.

The Knoxville Foundry & Machine Co., will install an electric traveling crane in its new foundry.

Chester Machine & Lumber Co., Chester, S. C., will buy one second hand lathe, and one second hand planer.

Sergeant Mfg. Co., Greensboro, N. C., asks prices on new and second hand iron lathes, planers, drill presses, etc.

Camp Mfg. Co., Franklin, Va., wants a small shaper for cutting key seats, making keys, etc.; also a drill press that will take in 36-inch wheels.

A company has been formed for the purpose of manufacturing malleable iron castings at East York, Pa.; capital $200,000.

Articles of incorporation of the North American Iron Co. were filed last week, at Elizabeth, N. J. The authorized capital of the company is $5,000,000. The company will engage in the iron mining business. The incorporators are John Ralston, James A. Pierson and William S. Bigelow, of Elizabeth.

New Construction:—

The Youngstown Range & Stove Co., Youngstown, O., will build a plant in Haselton, for the manufacture of stoves and ranges. It will be located on land adjoining the works of the Youngston Iron & Steel Roofing Co., and the main building will be 100x50 feet and two stories. John O. Pew, of the Youngstown Iron & Steel Roofing Co., is president and general manager; Mason Evans, secretary and treasurer. Superintendent Pierce, of the company, resigned a similar position with the Warren Range Co.

The Midland Rolling Mill Co., 860 Old Colony Bldg., Chicago, will have its new plant, 973-999 Fifty-first ave., in operation about Feb. 15. Angles and rounds will be rolled from old steel rails.

The Fayetteville (Ark.) Iron Work & Machine Shop, Baringer & Edmondson proprietors, will rebuild at once their plant recently burned. They desire to correspond with machinery dealers and manufacturers, asking prices on new and second hand lathes, shapers, planers, drill presses, cupola blowers, etc.

The West Virginia Steel Co., Wheeling, W. Va., has begun the erection of a six-mill plant in East Wheeling for the manufacture of steel sheets. The product will go into roofing, ceiling and sheet metal specialties heretofore put on the market by the Caldwell & Peterson Mfg. Co. The main building will be 100 x 200 feet. The contract for the sheet mills has been let in Pittsburg.

Plans for a frame and brick forge shop in Tacony, for the Philadelphia Forge Co., have been completed. The building will be one-story high, 40x90 feet, and special machinery is to be introduced.

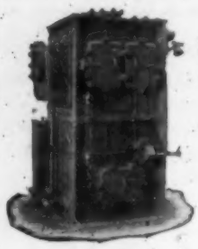
The Rahn-Mayer-Carpenter Co., of Cincinnati, is about to build a machine shop, 50x93 feet, and two stories, cost $3,000.

The Haven Malleable Casting Co., of Cincinnati, O., is erecting a plant at Dane st. and C. H. & D. Railroad. The ground cost $10,000. It will employ 250 to 300 hands.

The Schuylkill Iron & Steel Co., of Philadelphia, will make an extensive addition to its plant and has closed contract for new foundry buildings, office and pattern shop, and power plant. The new plant when completed will be the largest of its kind in the district. The foundry has a floor space of 328x81 feet and will be equipped with electric cranes capable of handling castings of the largest size. The power plant

Use

Cochrane Heaters.



A "Cochrane."

In every steam plant an exhaust steam feed-water heater will effect a saving of from 5% to over 20%, according to the conditions, whether the plant is operated high pressure, exhausting free to the atmosphere; whether operated under back pressure, using the waste steam for heating or drying, or whether it is operated condensing; even though these plants are equipped with economizers and provided with live steam purifiers. And while making this saving the exhaust steam feed-water heater will eliminate the strains caused by introducing cold water into economizers, live steam purifiers and boilers, which strains are chiefly recognizable in repair bills and stoppages.

Besides insuring the benefits referred to above, the right kind of a feed-water heater (a "Cochrane") will very materially improve any feed supply—no matter how bad—by eliminating some, or all, of the scale-forming matter present in the water, and by saving the exhaust condensed in accomplishing the heating.

HARRISON SAFETY BOILER WORKS,

Clearfield and Seventeenth Streets, PHILADELPHIA, PA.

will consist of boilers, engines, dynamos, motors, etc., electricity being the power employed. This company has large contracts on hand with Niles-Bement-Pond Co., Pratt & Whitney, Providence Engineering Works, Southwark Foundry & Machine Co. and others.

At Waterloo, Ia., it is reported the Tallerday Steel Pipe Co., recently incorporated, will erect a plant for the manufacture of steel pipe. The main building will be 48x150 feet, with an engine room, 16x24.

At Sioux City, Ia., advices are that the chief of engineers at Washington, D. C., has authorized the erection of a repair shop at the ice harbor at Riverside, for the repair of steamboats and machinery used in the government improvement work on the upper Missouri. The equipment will include dynamo, lathe, shaper, drill press, boiler maker's shears, punch, surfacer, circular, bandsaw, etc. Work will be commenced at once.

Contracts were let last week for the construction of three buildings for the Louisville (Ky.) Bolt & Iron Co. The price is in the neighborood of $20,000. The buildings will be one story in height, and will occupy a space 200x200 feet.

The Harrow Spring Co., Kalamazoo, Mich., is planning the building of a plant for rolling its material.

The American Radiator Co. is receiving proposals for an addition to its Detroit plant. Specifications include two steel traveling cranes, structural iron, galvanized iron, steam pipe covering.

Ireland & Matthews Mfg. Co., Detroit, are to erect a forge house 160x40 feet.

The Harrisburg (Pa.) Pipe and Pipe Bending Co., recently incorporated with a capital of $1,000, has given notice of an increase of the capital stock to $400,000. The company will greatly enlarge the present plant and manufacture pipe.

The Knoxville (Tenn.) Foundry & Machine Co., John P. Staub, manager, will rebuild its foundry building, recently burned.

The Pittsburg District:—

The large steel frame palace which is being constructed for the Crown Prince of Japan contains over 72,000 square feet of floor area. Corrugated arches of No. 16 gauge steel are to be placed between the floor beams. About 125 tons of curved corrugated steel sheets manufactured by Wm. B. Scaife & Sons, Pittsburg, Pa., will be required in this connection.

Victor Peyras, Lucien Marechal and A. Paris, officials of the Paris, Lyons and Mediterranean Railroad, have been in Pittsburg for some time, in negotiation with the Pressed Steel Car Co., with a view of placing a large order for steel cars.

The Colonial Coke Co. is building a battery of 100 coke ovens at its coal tract at Smock, Pa.

The Miller Engineering Co., Pittsburg, will apply for a charter Feb. 5, the capital stock to be $50,000. The company will do a general engineering business in iron and steel. The incorporators will be William R. Miller, John M. Tate, Jr., Dale S. Date, Harry L. Borland and William A. Jordan.

Application will be made Feb. 7 for the incorporation of the Eureka Mfg. Co., Pittsburg, under the general laws of Pennsylvania for iron and steel manufacturing concerns. The incorporators will be Henry B. Haarlander, Benjamin H. Taylor, James H. McCready, Peter J. Edwards and James E. Rogers.

The Braddock Machine & Mfg. Co., Braddock, Pa., recently organized, and re-organized the first of the year, has let a number of contracts for its new plant at Braddock. The buildings will be erected by the Pittsburg Bridge Co., there being three buildings, 60x300 feet, 80x200 feet and 30x200 feet respectively. The Monongahela Machine Tool Co., Pittsburg, which will act as selling agent for the Braddock concern, has the contract for the three motor traveling cranes, one 20 and two 15 ton, to be built by the Northern Engineering Co., Detroit, Mich., and has also the contract for the machine tool equipment. The Reading (Pa.) Crane & Hoist Works will furnish a 10-ton hand crane and the Whiting Foundry Equipment Co., Harvey, Ill., will build the cupola. The company will manufacture air compressors, pulley blocks and hangers, etc. The whole plant will be run by gas engines.

Moorhead Bros. & Co., at Sharpsburg, Pa., will put in eight additional puddling furnaces, which they expect to have completed within the next three weeks. This will greatly increase the output of the plant and will give employment to 48 additional men.

Patton & Gibson, contractors, of Pittsburg, have the contract for the removal of the largest pile of coke in the world, the coke reserve of the Carnegie Steel Co., located near the main line of the Pennsylvania Railroad at Bessemer. The pile, all first-classs coke, is 2,000 feet long, 600 feet wide and 150 feet high. It contains approximately 500,000 cubic yards of coke. The contract provides that the pile be loaded on cars for shipment in 60 days from Jan. 15. The coke will be shipped to the various furnaces of the company as soon as it is loaded.

R. D. Nuttall Co. will make extensive improvements at their machine shop.

The Pittsburg Coal Co. is reported to have contracts with the American Tin Plate Co., American Steel Hoop Co., and the National Steel Co. to furnish plants in their territory with coal for three years.

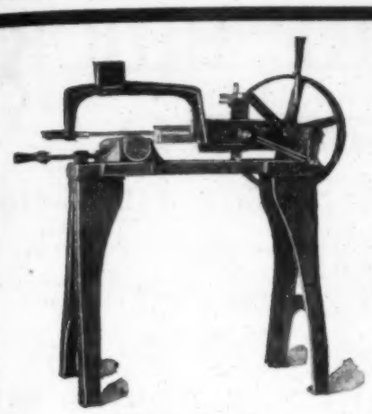
Chicago District and Northwest:—

An accident to the hoisting machine at the blast furnaces at Bay View, Wis., caused a shut-down of several days.

The plants of the American Steel & Wire Co., at Cincinnati, O., has been entirely stripped and the machinery has been shipped to Waukegan, Ill. Men are now engaged dismantling the St. Louis works. This great amount of material from the two plants is to be stored at the Waukegan plant and in the course of improvements at the works there much will be used, the remainder being scrapped.

The proposed improvements and additions for the three plants at the head of Lake Superior that have been sold to the Lake Superior Steel Co. contemplate the outlay of $535,000. This is divided as follows: General repairs and alterations, $185,000; new open-hearth steel plant for the Ironton structural steel plant, $200,000, and a continuous combination 12-inch and 14-inch mill for the West Superior steel plant for the manufacture of small merchant bars to cost $150,000.

All three of the rod mills of the Illinois Steel Co., at Joliet,



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Ill., have resumed work after a shut down of two months to make repairs. The McKenna mills, which re-roll old rails, started last week after a long shut-down. Two hundred men were put to work.

All work at the Evanston (Ill.) plant of the American Steel & Wire Co. is now stopped and the company is moving all its machinery as fast as possible to De Kalb.

Announcement is made that the plant of E. S. Stiles Press Co., of Watertown, N. Y., including patterns, patents, machine tools, etc., has been purchased and will be operated by G. A. Crosby & Co., 176-178 South Clinton st., Chicago. The plant is now being installed at the Crosby company's works and orders are being accepted for early delivery. E. S. Stiles announces that he has associated himself with G. A. Crosby & Co. and that he will give his personal attention to all matters pertaining to the old business.

The Inland Steel Co., Marquette Bldg., Chicago, will operate its Chicago Heights plant in full as heretofore. The new mills under construction at Tonawanda, N. Y., will be in operation about June 1. The buildings will be of steel construction, occupying about 50,000 square feet of floor space. The output is estimated at about 30,000 tons a year.

The Chicago Fire Proof Covering Co. reports an actual demand for its "Anti-Flame" fire-proof paint. It recently made a shipment of three cars to a mine and ranch owner in old Mexico and is coating about 400,000 square feet for the Illinois Central Railroad, at New Orleans.

The Brussard Mfg. Co., Chicago, has been incorporated. Capital, $2,500, to manufacture machinery.

The Lakeside Stove Co., Chicago, has been incorporated. Capital $2 500 to manufacture stoves and heaters.

Fires and Accidents:—

W. B. Stone's foundry and machine shops, at Galena, Kas., were entirely destroyed by fire Jan. 9, with a loss of $20,000; no insurance. The works will be rebuilt at once on a more extensive scale than ever. Machinery for zinc and lead mining is manufactured.

The Davis Iron Works at Denver, Col., burned Jan. 10. The loss will reach $100,000; insured.

Two of the large blowing engines at the Lorain Steel Co.'s blast furnaces Lorain, O., were disabled last week. The back steam and air heads were blown out and the connecting rods broken. Relief engines will keep the plant in operation while repairs are being made.

The rolling mill of the Danville & Bessemer Steel Co. was damaged by fire Jan. 13 to the extent of $50,000.

At Glens Falls, Warren Co., N. Y., Budd Brothers D. & H. Bicycle Works, were destroyed by fire Jan. 13.

The foundry of the Portage Lake Foundry & Machine Co. was partly destroyed by fire, a Houghton, Mich., dispatch says.

At Madison, Wis., fire in the State University machine shops caused loss of $6,000.

General Industrial Notes:—

At the opening of bids by the city of Philadelphia on Dec. 28, 1899, the Schuylkill Iron & Steel Co. was the lowest for furnishing the water bureau with fire hydrant stop castings and grate bars. The work amounts to about $40,000.

Gray iron castings of every description are now made to order to any specifications at the plant of the Stover Gasoline Engine Works, at Freeport, Ill. The company will send estimates in advance for any such work their correspondents may have in contemplation.

The Weimer Machine Works Co., of Lebanon, Pa., have the followig orders for their cinder cars of 200 cubic feet capacity: National Steel Co., Ohio works, six cars; Carnegie Steel Co., Ltd, Rankin, Pa., 24 cars; Dominion Iron & Steel Co., Canada, 15 cars; Empire Steel & Iron Co., Bellefonte, Pa., one car; Maryland Steel Co., Sparrow's Point, Md., one car;

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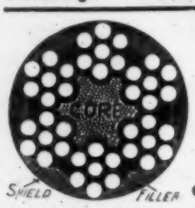

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BUHL MALLEABLE CO., Detroit, Mich.

Tennessee Coal, Iron & Railroad Co., Ensley, Ala., three cars; Millom & Askam Hematite Iron Co, Millom, Eng., two cars.

The C. Kratz foundry and machine shops at Evanston, Ind., have been sold at sheriff's sale to George L. Mesker, for $10,000. The property represents $50,000.

The blooming mill of the Alabama Steel & Shipbuilding Co.'s new steel plant at Ensley, Ala., has begun operations, and is working saitsfactorily. In a few weeks the steel mill will be in full blast, three open-hearth furnaces being in operation now and the remaining seven being nearly completed. It will be several weeks before the steel wire and rod mill, which will consume a large part of the steel plant's output, will be ready for operation.

The Valley Rolling Mill in the Sharon, Pa., district, leased by the Continental Iron Co., has resumed after two months' idleness.

The Sanderson Steel Works, of Syracuse, N. Y., have been shut down for repairs, but are now active again.

The plant of the Ohio Iron Co., located at Zanesville, O., has been purchased by Western capitalists and will be placed in operation inside of six weeks. The mill has been idle for almost ten years.

The molders employed in the foundry of the March-Brownback Stove Co., at Pottstown, Pa., struck last week on account of a difference of 5 cents per piece in the price paid for making stove backs. The district union rate is 5 cents higher than the company pays.

A syndicate has secured the rolling mill of the Hollidaysburg (Pa.) Iron & Nail Co., and will start up the plant on merchant iron after an idleness of two years.

To force a 10 per cent increase in wages, 125 machinists struck in the Watson and in the Eastwood shops of Paterson, N. J. The men are organized.

New England Foundrymen's Association.

The annual meeting of the New England Foundrymen's Association was held on Wednesday, January 10, at 4 p. m. at the Revere House, Boston. Members dined together at 6 and for the remainder of the evening the program was

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furnished by the executive committee. The following are the nominees presented for office for the ensuing year: President, Walworth O. Barbour, Barbour Stockwell Co., Cambridgeport, Mass.; vice-president, George B. Buckingham, Arcade Malleable Iron Co., Worcester, Mass.; secretary, Fred. F. Stockwell, Barbour Stockwell Co.; treasurer, George H. Lincoln, George H. Lincoln & Co., South Boston. Executive committee—H. A. Carpenter, A. Carpenter & Sons Foundry Co., Providence, R. I.; T. H. Colvin, Colvin Foundry Co., Providence; B. M. Shaw, Walker & Pratt Mfg. Co., Watertown, Mass.; William Doherty, Doherty Bros., Lowell, Mass; W. F. Durant, G. F. Warner Mfg. Co., New Haven.

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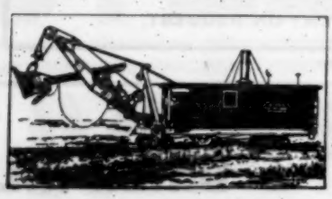

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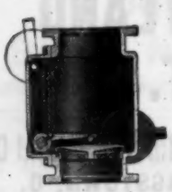

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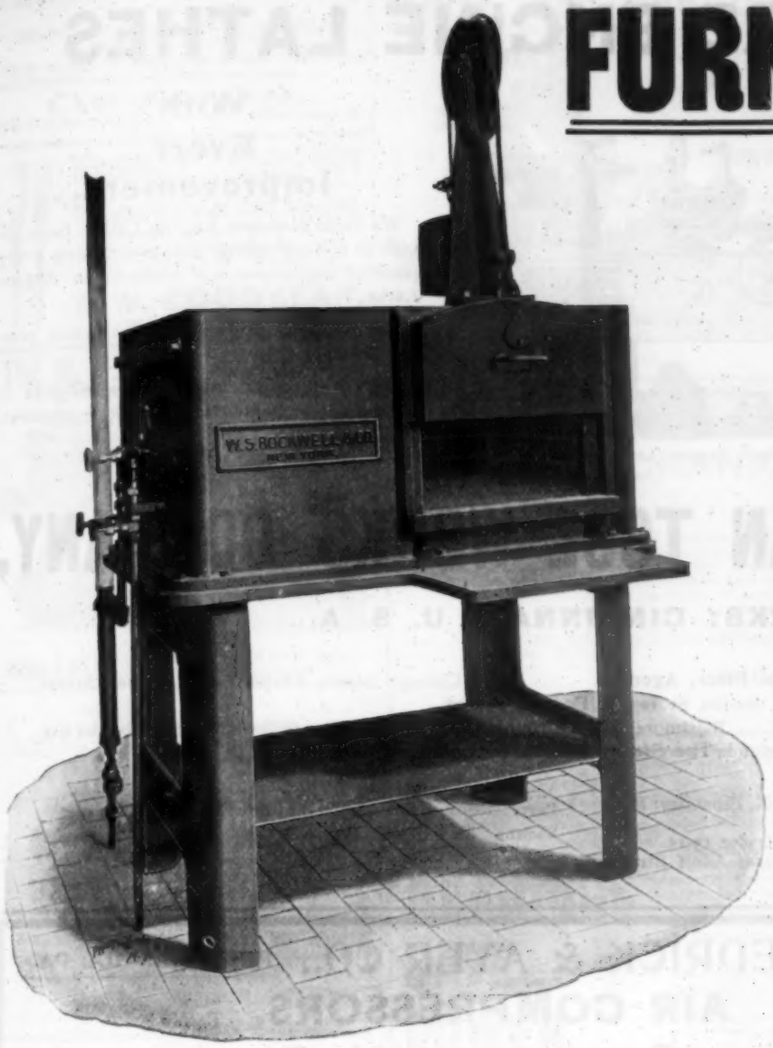

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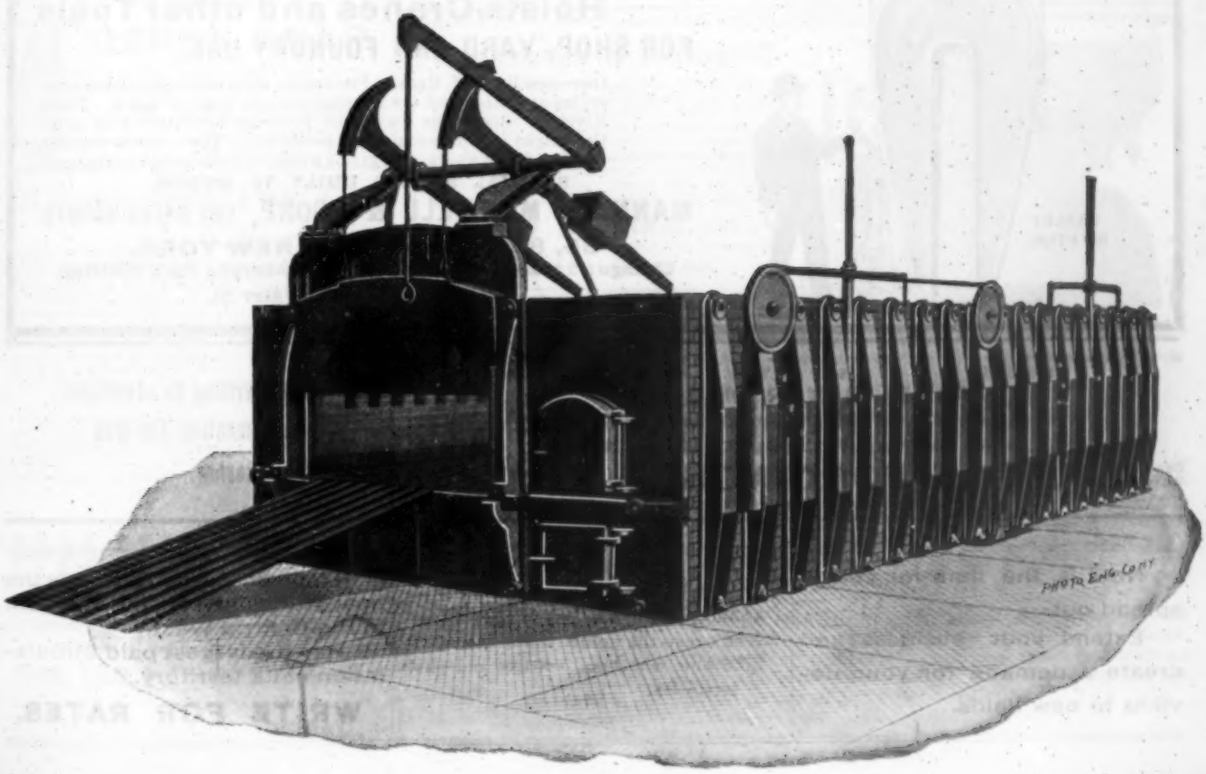

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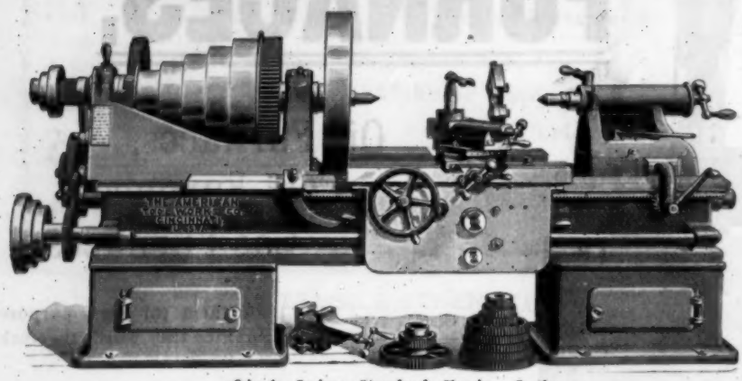

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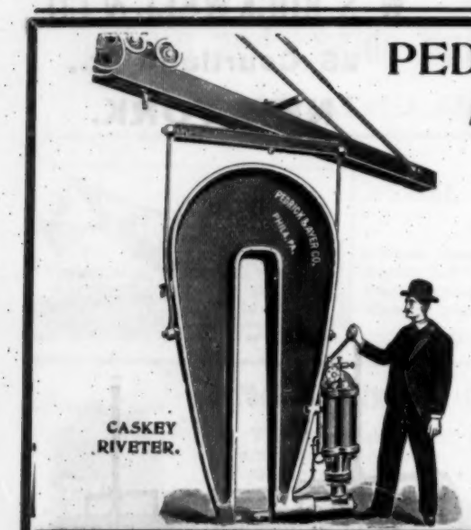

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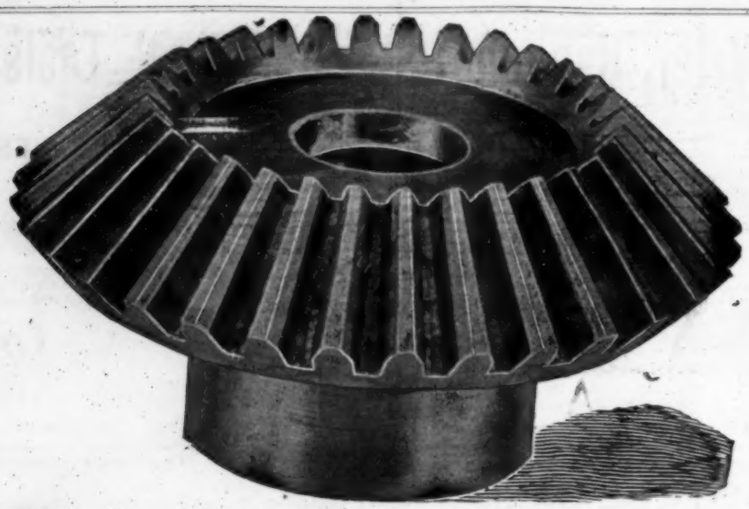

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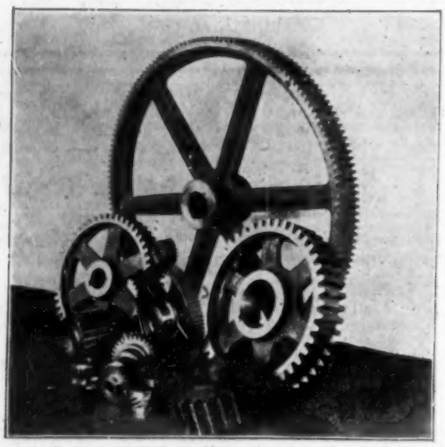

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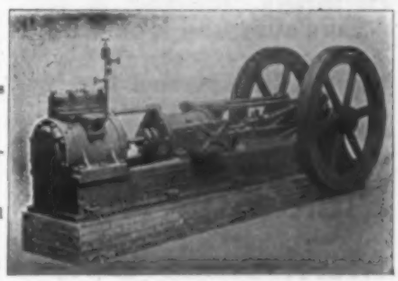

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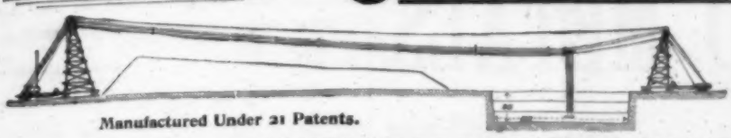

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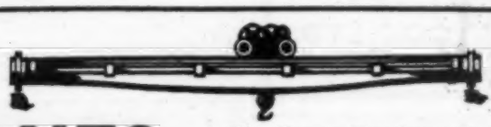

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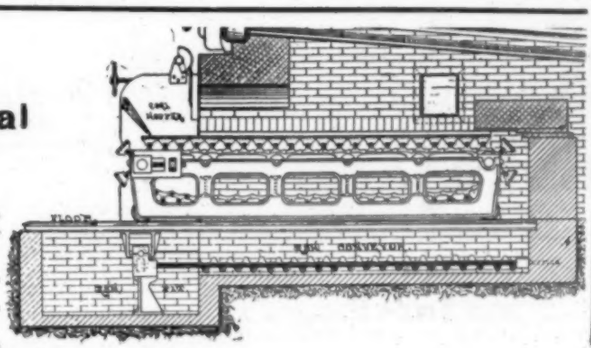

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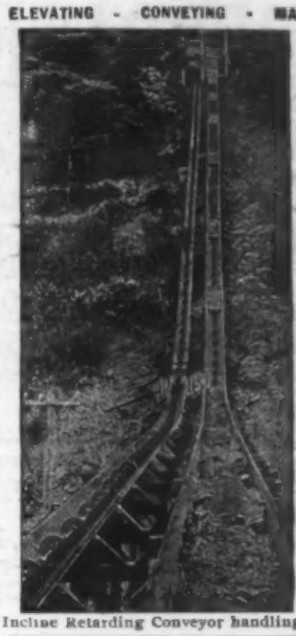

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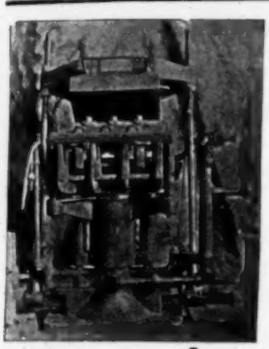

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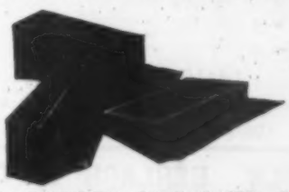

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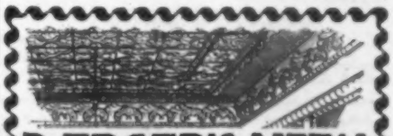

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The methods for analysis of iron ore, iron and steel and for assaying have been given briefly, but perhaps as much in detail as is consistent with the general scope of the book. Several changes and additions to the Specific Gravity tables have been made by adoption of later and more accurate values.

In the notes on blast furnace practice have been outlined the more important theoretical and practical points, which, it is hoped, will be of some service to those interested in the manufacture of iron.

The hygrometric table gives the necessary information for determining the amount of moisture in air, a subject whose importance in metallurgical operations is being more fully recognized at present than heretofore. This table is new and is based on the most accurate data available at the present time.

The tables of weights and measures, United States and foreign, have been very much amplified, and the conversion tables for United States and metric weight and measures of the U. S. Coast and Geodetic Survey included, the latter being based on the legal standard for this country.

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.....	8:10	1:30	Bridgeport	.....	6:05	1:40	
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The methods for analysis of iron ore, iron and steel and for assaying have been given briefly, but perhaps as much in detail as is consistent with the general scope of the book. Several changes and additions to the Specific Gravity tables have been made by adoption of later and more accurate values.

In the notes on blast furnace practice have been outlined the more important theoretical and practical points, which, it is hoped, will be of some service to those interested in the manufacture of iron.

The hygrometric table gives the necessary information for determining the amount of moisture in air, a subject whose importance in metallurgical operations is being more fully recognized at present than heretofore. This table is new and is based on the most accurate data available at the present time.

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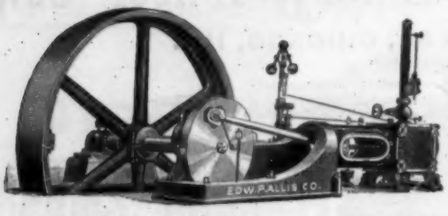

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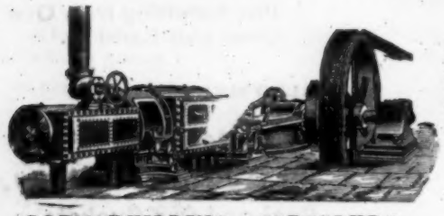

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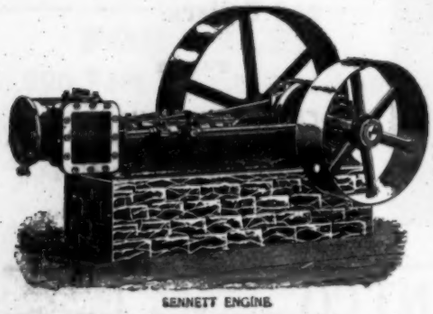

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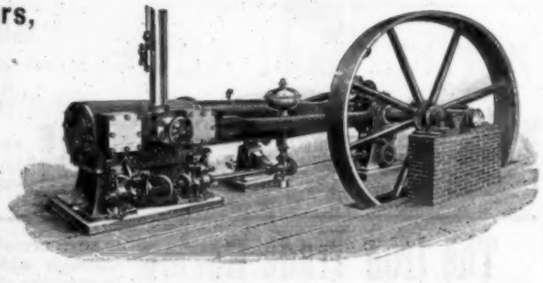

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Ætna-Standard Iron & Steel Co., Bridgeport, O.
Cincinnati Corrugating Co., Piqua, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.

COTTON TIES—
American Steel Hoop Co., Pittsburg, Pa.

CRANES—
Northern Engineering Works, Detroit, Mich.
Wm. Tod & Co., Youngstown, O.
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.
Whiting Foundry Equipment Co., Harvey, Ill.
Brown Hoisting and Conveying Machine Co., Cleveland, Ohio.
Excelsior Iron Works Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
Cleveland Crane & Car Co., Cleveland, O.

CRANK HANDLES—
Norwood Bicycle Co., Cincinnati, O.

CRANK PINS—
Bethlehem Steel Co., S. Bethlehem, Pa.

CUPOLAS—
Riter-Conley Mfg. Co., Pittsburg, Pa.
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co , Harvey, Ill.
The United Boiler Co., Girard, O.

CUTTER AND REAMING GRINDERS—
American Tool Works Co., Cincinnati, O.

DIES—
Danielson Machine & Tool Co., Cleveland, O.

DREDGES—
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.
The Jeffrey Mfg. Co., Columbus, O.

DRILL GRINDERS—
J. Wendell Cole Columbus, O.

DRILLING MACHINERY—
Keystone Driller Co., Beaver Falls, Pa.

DRILL PRESSES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass.
Manning, Maxwell & Moore, New York City.
Danielson Machine & Tool Co., Cleveland, O.

DROP FORGINGS—
Wyman & Gordon, Worcester, Mass.
Chicago Drop Forge & Foundry Co., Kensington, Ill.
Jas. H. Baker Mfg. Co., Pittsburg, Pa.

DROP HAMMERS—
Baush & Harris Machine Tool Co., Springfield, Mass.

DROP PRESSES—
Avery Stamping Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
R. Konigslow & Bro., Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.

DYNAMOS—
Jeffrey Mfg. Co., Columbus, O.

EAVE TROUGHS AND CONDUCTORS—
Berger Mfg. Co., Canton, O.

ELEVATORS—
Whiting Foundry Equipment Co., Harvey, Ill.

ELEVATING AND CONVEYING MACHINERY—
Heyl & Patterson, Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Lidgerwood Mfg. Co., New York City.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster Camp & Lane Machine Co., Akron, O
Buhl Malleable Co., Detroit, Mich.
Excelsior Iron Works Co., Cleveland, O.

EMERY AND CORUNDUM WHEELS—
Star Corundum Wheel Co., Detroit, Mich.
C. H. Besley & Co., Chicago, Ill.
J. Wendell Cole, Columbus and Chicago.
Northampton Emery Wheel Co., Chicago, Ill.
W. P. Davis Machine Co., Rochester, N. Y.

EMERY WHEEL MACHINERY—
J Wendell Cole, M.E., Columbus, O., or Chicago
Star Corundum Wheel Co., Detroit, Mich.
C. H. Besly & Co., Chicago, Ill.
Northampton Emery Wheel Co., Chicago, Ill.
W. P. Davis Machine Co., Rochester, N. Y.

ENGINEERS AND CONTRACTORS—
Wellman-Seaver Engineering Co., Cleveland, O.
Walter Kennedy, Pittsburg, Pa.
Heyl & Patterson, Pittsburg, Pa.
Meehan Boiler & Construction Co., Lowellville, O
E. R. Erickson, Pittsburg, Pa.
John T. Jones & Co., Chicago, Ill.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Julian Kennedy, Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Alex Laughlin & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
James Bonar & Co., Pittsburg, Pa.

ENGINE PACKING—
Jenkins Bros., New York City.
C. H. Besly & Co., Chicago, Ill.
James B. Clow & Sons, Chicago, Ill.

ENGINEERS' SUPPLIES—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
James B. Clow & Sons, Chicago, Ill.

ENGINE LATHES—
U. Baird Machinery Co., Pittsburg, Pa.
American Tool Works Co., Cincinnati, O.

ENGINES (OIL)—
The Aultman Co., Canton, O.

ENGINES STEAM)—
W. P. Davis Machine Co., Rochester, N. Y
Wm. Tod & Co., Youngstown, O.
The Edward P. Allis Co., Milwaukee, Wis
The Hooven, Owens & Rentschler Co., Hamilton, O.
The Anltman Co., Canton, O.
Geo. B. Sennett Co., Youngstown, Ohio.

ENGRAVERS AND ELECTROTYPERS—
Central Electrotype & Engraving Co., Cleveland.
National Engraving Co., Cleveland, O.,
Samuel R. Mason, Cleveland, O.

FEED WATER HEATERS AND PURIFIERS—
Harrison Safety Boiler Works, Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
Austin Separator Co., Detroit, Mich.

FELLOE PLATES—
Avery Stamping Co., Cleveland, O.

FILES, MAKERS OF—
C. H. Besly & Co., Chicago, Ill.

FILTERS—
Wm. B. Scaife & Sons, Pittsburg, Pa.

FIRE BRICK AND CLAY—
J. V. Rose, Sharon, Pa.
Union Mining Co., Mt. Savage, Md.
Clearfield Fire Brick Co., Clearfield, Pa.
Dover Fire Brick Co., Cleveland, O.
F. B. Stevens, Detroit, Mich.
Chicago Fire Clay Product Co., Chicago, Ill.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Detroit, Mich.
Garden City Sand Co., Chicago, Ill.
A. F. Smith & Co., New Brighton, Pa.
Chas. Taylor's Sons Co. Cincinnati, O.

FIRE PROOF COVERING—
C. H. Besly & Co., Chicago, Ill.

FLEXIBLE SHAFTS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

FLUE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

FOOT AND POWER LATHES—
U. Baird Machinery Co., Pittsburg, Pa.

FORGINGS—
Chicago Drop Forge & Foundry Co., Kensington, Ill.
Cleveland City Forge & Iron Co., Cleveland, O.
Bethlehem Steel Co., South Bethlehem, Pa.
Braeburn Steel Co., Braeburn, Pa.
Wyman & Gordon, Worchester, Mass.
Danielson Machine & Tool Co., Cleveland, O.
Samuel Trethewey & Co., Pittsburg, Pa.
Jas. H. Baker Mfg. Co., Pittsburg, Pa.

FOUNDRIES—
Wm. Tod & Co., Youngstown, O.
Seaman, Sleeth Co., Pittsburg, Pa.
Hooven, Owens & Rentschler Co., Hamilton, O.
W. A. Jones Foundry Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
Brass Founders' Supply Co., Newark, N. J.
The Aultman Co Canton, O.
Schuylkill Iron & Steel Co., Philadelphia, Pa.
Stover Gasoline Engine Works, Freeport, Ill.
Riverside Foundry Co., Cleveland, O.
I. & R. Greenwald Co., Cincinnati, O.
Wheeling Mold & Foundry Co., Wheeling, W.Va.
Excelsior Iron Works Co., Cleveland, O.
Macbeth & Co., Cleveland, O.
Vulcan Foundry & Machine Co., New Castle, Pa

FOUNDRY EQUIPMENT.
Tabor Mfg. Co., Elizabeth, N. J.
Brass Founders Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Northern Engineering Works, Detroit, Mich.
Cleveland Crane & Car Co., Cleveland, O.
Whiting Foundry Equipment Co , Harvey, Ill.

FOUNDRY FACINGS—
Cleveland Facing Mill Co., Cleveland, O

FOUNDRY SUPPLIES—
Northern Engineering Works, Detroit, Mich.
Chas. Taylor's Sons Co., Cincinnati, O.
Clearfield Fire Brick Co., Clearfield, Pa.
Cleveland Crane & Car Co , Cleveland, O.
The Ohio Sand Co., Conneaut, O.
Union Mining Co., Mt. Savage, Md.
Dover Fire-Brick Co., Cleveland, O.
A. F. Smith & Co., New Brighton

Tabor Mfg. Co., Elizabeth, N. J.
F. B. Stevens, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.
Cleveland Facing Mill Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.
Chicago Fire Clay Product Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth, O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
J. V. Rose, Sharon, Pa.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.

FRICTION METAL—
James B. Clow & Sons, Chicago, Ill.
Theo. Hiertz & Son, St. Louis, Mo.
C. H. Besly & Co., Chicago, Ill.
Swarts Metal Refining Co., Chicago, Ill.
Magnolia Metal Co., New York City.
Perfect Lubricating Metal Co., Cincinnati, O.
Merchant & Co., Inc., Philadelphia, Pa.
F. R. Phillips' Sons Co., Philadelphia, Pa.
J. J. Ryan & Co., Chicago. Ill.

FURNACES—
Playford Stoker Co., Cleveland, O.

FURNACE LININGS—
Union Mining Co., Mt. Savage, Md.

FURNACE, MELTING—
Whiting Foundry Equipment Co., Harvey, Ill.

FUEL OIL BURNERS—
W. S. Rockwell & Co., New York City.

GALVANIZED IRON—
Apollo Iron & Steel Co., Pittsburg, Pa.

GALVANIZERS—
Ætna-Standard Iron & Steel Co., Bridgeport, O
Apollo Iron & Steel Co., Pittsburg, Pa.

GALVANIZING POTS—
The Wm. B. Pollock Co., Youngstown, O.

GAS ENGINES—
Northern Engineering Works, Detroit, Mich.

GAUGE COCKS—
James Bonar & Co., Pittsburg, Pa.

GEARING—
I. & E. Greenwald Co., Cincinnati, O.
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.
Fraser & Chalmers, Chicago, Ill.
Southwark Foundry & Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.

GEAR CUTTING—
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.

GEAR LUBRICANTS—
The Ironsides Company, Columbus, O.

GIRDER WORK—
Wm. B. Scaife & Sons, Pittsburg, Pa.

GRINDSTONES—
C. H. Besly & Co., Chicago, Ill.

GRAPHITE PAINT—
Jos Dixon Crucible Co., Jersey City, N. J.

GRATE BARS—
Geo. B. Sennett Co., Youngstown, Ohio.

GRAY IRON CASTINGS—
W. A. Jones Foundry Co., Chicago, Ill.
Brass Founders' supply Co., Newark, N. J.

HACK SAWS—
Q & C Co., Chicago, Ill.

HANDLES—
Norwood Bicycle Co., Cincinnati, O.

HANGERS—
R. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & E. Greenwald Co., Cincinnati, O.

HARNESS SNAPS—
Covert Mfg. Co., West Troy, N. Y.

HEATERS AND PURIFIERS—
Harrison Safety Boiler Works, Philadelphia.
James Bonar & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
Austin Separator Co., Detroit, Mich.
The United Boiler Co., Girard, O.

HEAVY HARDWARE—
C. H. Besly & Co., Chicago, Ill.
Parkhurst & Wilkinson Co., Chicago, Ill.

HOISTS—
The Aultman Co., Canton, O.
Lidgerwood Mfg. Co., New York City.

HOISTING ENGINES—
The Edward P. Allis Co., Milwaukee, Wis.
Lidgerwood Mfg. Co., New York City.
The Aultman Co., Canton, O.
Webster, Camp & Lane Machine Co., Akron, O.
Excelsior Iron Works Co., Cleveland, O.

HOISTING MACHINERY—
Link-Belt Machinery Co., Chicago, Ill.
Jeffrey Mfg. Co. Columbus, O.
Excelsior Iron Works Co., Cleveland, O.
Lidgerwood Mfg. Co. New York City.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster, Camp & Lane Machine Co., Akron, O.

HORSE SHOES—
Phoenix Horse Shoe Co., Joliet, Ill.

IMPULSE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

INDUSTRIAL CARS—
The Pressed Steel Car Co., Pittsburg, Pa.

INGOT MOLDS—
Lorain Foundry Co., Lorain, O.

INJECTORS—
C. H. Besly & Co., Chicago, Ill.
Manning, Maxwell & Moore, New York City.
James Bonar & Co., Pittsburg, Pa.

INSURANCE COMPANIES—
Hartford Steam Boiler I. & I. Co., Hartford, Ct.

IRON BUILDINGS—
Universal Construction Co., Chicago, Ill.
Schiffler Bridge Co., Pittsburg, Pa.
Riter-Conley Co., Pittsburg, Pa.
Wm. B. Scaife & Sons, Pittsburg, Pa.

IRON, NAILS AND STEEL—
C. H. Besly & Co., Chicago, Ill.
W. H. Stroud & Co., Chicago, Ill.
Parkhurst & Wilkinson Co., Chicago, Ill.
L. K. Hirsch, Chicago, Ill.

IRON AND STEEL ROOFING—
Berger Mfg. Co., Canton, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O
Cincinnati Corrugating Co., Piqua, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.

IRON ORE—
Lake Superior Consolidated Iron Mines New York City, N. Y.
Oglebay, Norton & Co., Cleveland, O.
Pickands, Brown & Co., Chicago, Ill.
M. A. Hanna & Co., Cleveland, O.
Drake Bartow & Co., Cleveland, O.
Pickands, Mather & Co., Cleveland, O.

IRON WORKING TOOLS—
Avery Stamping Co., Cleveland, O.
American Tool Works Co., Cincinnati, O.
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Armstrong Bros. Tool Co., Chicago, Ill.
The Armstrong Mfg. Co., Bridgeport, Conn.
Bickford Drill & Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass
W. P. Davis Machine Co., Rochester, N. Y.
Manning, Maxwell & Moore, New York City.
Bertsch & Co., Cambridge City, Ind.

LADLES—
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.
The United Boiler Co., Girard, O.

LATHES—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
American Tool Works Co., Cincinnati, O.

LINK BELTING—
The Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.

LOCOMOTIVES—
L. K. Hirsch, Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.

MACHINISTS' TOOLS AND SUPPLIES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bertsch & Co., Cambridge City, Ind.
Armstrong Bros. Tool Co., Chicago, Ill.
Bickford Drill & Tool Co., Cincinnati, O.
Parkhurst & Wilkinson Co., Chicago, Ill.
Baush & Harris Machine Tool Co., Springfield Mass.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.

MACHINE SCREWS—
C. H. Besly & Co., Chicago, Ill.

MACHINE SHOPS—
The R. D. Nuttall Co., Allegheny, Pa.
Danielson Machine & Tool Co., Cleveland, O.

MACHINERY AND TOOL STEEL—
C. H. Besley & Co., Chicago, Ill.
Braeburn Steel Co., Braeburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa
Byron H. White, Chicago, Ill.
Morris & Bailey Steel Co., Pittsburg, Pa.
Monongahela Iron & Steel Co., Pittsburg, Pa.

MAGNESIA COVERING—
C. H. Besly & Co., Chicago, Ill.
James B. Clow & Sons, Chicago, Ill.

MALLEABLE FOUNDRY PLANTS—
Whiting Foundry Equipment Co., Harvey, Ill.

MALLEABLE CASTINGS—
Acme Malleable Iron Works, Buffalo, N. Y.
Buhl Malleable Co., Detroit, Mich.

MANUFACTURING CHEMISTS—
We Fu Go Co., Cincinnati, O.
Grasselli Chemical Co., Cleveland, O.

MANUFACTURED IRON AND STEEL—
Bourne-Fuller & Co., Cleveland, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Parkhurst & Wilkinson Co., Chicago, Ill.
Ohio Steel Co., Youngstown, O.
Republic Iron & Steel Co., Chicago, Ill.
Monongahela Iron & Steel Co., Pittsburg, Pa.

METAL BEARINGS—
Theo. Hiertz & Son, St. Louis, Mo.
C. H. Besly & Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Magnolia Metal Co., New York City.
Swarts Metal Refining Co., Chicago, Ills.
F. R. Phillips' Sons Co., Philadelphia, Pa.
J. J. Ryan & Co., Chicago, Ill.

METAL CEILINGS—
Berger Manufacturing Co., Canton, O.

METAL WORK—
Avery Stamping Co, Cleveland, O.

MILL CASTINGS—
Vulcan Foundry & Machine Co., New Castle, Pa.

MILLING MACHINES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.

MINING MACHINERY—
C. H. Besly & Co., Chicago, Ill.
The Edward P. Allis Co., Milwaukee, Wis,
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co., New York City.
Wm. Cramp & Sons, Philadelphia, Pa
The Bucyrus Co., South Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.
Webster, Camp & Lane Machine Co., Akron, O.
Fraser & Chalmers, Chicago, Ill.
Excelsior Iron Works Co., Cleveland, O.

MINE PUMPS—
F. M. Prescott Steam Pump Co., Milwaukee, Wis.

MOLDING MACHINES—
Tabor Mfg. Co., Elizabeth, N. J.
Whiting Foundry Equipment Co., Harvey, Ill.

MOLDING SAND—
Ohio Sand Co., Conneaut, O.
F. B. Stevens, Detroit, Mich.
Garden City Sand Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.

MULTIPLE DRILLS—
Bickford Drill and Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass.

NICKEL PLATING OUTFITS—
Northampton Emery Wheel Co., Chicago, Ill.

NUTS AND BOLTS—
Upson Nut Co., Cleveland, O.

OILLESS BEARINGS—
C. H. Besly & Co., Chicago, Ill.

OIL BURNERS—
W. S. Rockwell & Co., New York City.

OIL CUPS—
C. H. Besly & Co., Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.

OIL FILTERS—
James Bonar & Co., Pittsburg, Pa.

OIL PUMPS—
C. H. Besly & Co., Chicago, Ill.

OIL SEPARATORS—
Harrison Safety Boiler Works, Philadelphia, Pa.
Austin Separator Co., Detroit, Mich.
American Tool Works Co., Cincinnati, O.

ORE CARS—
The Pressed Steel Co. Pittsburg, Pa.

ORE CRUSHERS—
The Edward P. Allis Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers Chicago, Ill.

ORE SCREENS—
Rob't Aitchison Per. Metal Co., Chicago, Ill.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.

ORE TESTING MACHINERY—
Keystone Driller Co., Beaver Falls, Pa.

PACKING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
James B. Clow & Sons, Chicago, Ill.

PAINT—
Iron Clad Paint Co., Cleveland, O.
Jos. Dixon Crucible Co., Jersey City, N. J.

PATTERN WORKS—
Gobeille Pattern Co., Cleveland, O.
Forsythe Pattern Works, Youngstown, O.

PERFORATED METALS—
Aitchison Perforated Metal Co., Chicago, Ill.
Fraser & Chalmers, Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.

PIG IRON—
Rogers, Brown & Co., Cincinnati, O.
Reed F. Blair & Co., Pittsburg, Pa.
Clinton Iron & Steel Co., Pittsburg.
Bourne-Fuller Co. Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
E. H. Strond & Co., Chicago, Ill.
Pickands, Brown & Co., Chicago, Ill.
F. B. Stevens, Detroit, Mich.
McKeefrey & Co., Lecionis, O.
Superior Charcoal Iron Co., Grand Rapids, Mich
Spearman Iron Co., Sharpsville, Pa.
Hickman, Williams & Co., Chicago, Ill.
The Brier Hill Coal & Iron Co., Youngstown, O.
Pickands, Mather & Co., Cleveland, O.
Republic Iron & Steel Co., Chicago, Ill.
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill,

PIG IRON CASTING APPARATUS—
Heyl & Patterson, Pittsburg, Pa.
G. H. Ginther, Special Agent, Pittsburg, Pa.

PIPE (CAST IRON)—
James B. Clow & Sons, Chicago, Ill.

PIPE (RIVETED STEEL)—
Wm. B. Scaife & Sons, Pittsburg, Pa.

PIPE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

PIPE COVERING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

PIPE CUTTING AND THREADING MACHINES—
The Armstrong Mfg. Co., Bridgeport, Conn.

PIPE FOUNDRY PLANTS—
Whiting Foundry Equipment Co., Harvey, Ill.

PISTON RODS—
Bethlehem Steel Co., So. Bethlehem, Pa.

PLANERS—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O
Manning, Maxwell & Moore, New York City.
American Tool Works Co., Cincinnati, O.

PLATES—
Enterprise Boiler Co., Youngstown, O.
Republic Iron & Steel Co., Chcago, Ill.
Universal Construction Co., Chicago, Ill.

PLUMBERS' AND GAS FITTERS' SUPPLIES—
C. H. Besly & Co., Chicago, Ill.
James B. Clow & Sons, Chicago, Ill.

PNEUMATIC APPLIANCES—
Clayton Air Compressor Works, New York.

PNEUMATIC TOOLS—
American Pneumatic Tool Co., New York City
Q & C Co., Chicago, Ill.
W. J. Schaefer & Co., New York City.

PORTABLE FORGE—
C. H. Besly & Co., Chicago, Ill.
Vulcan Mfg. Co., Pittsburg, Pa.

POWER DROP HAMMERS—
Baush & Harris Machine Tool Co., Springfield Mass.

POWER PRESSES—
Avery Stamping Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
E. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.

POWER TRANSMISSON MACHINERY—
Jeffrey Mfg. Co., Columbus, O.
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & E. Greenwald Co., Cincinnati, O.

PRESSES—
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
E. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.
Avery Stamping Co., Cleveland, O.

PRESSURE GAUGES—
The Bristol Co., Waterbury, Conn.
James Bonar & Co., Pittsburg, Pa.

PULLEYS—
W. A. Jones Foundry Co., Chicago, Ill
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa
I. & E. Greenwald Co., Cincinnati, O.

PUMPS (STEAM)—
The Edward P. Allis Co., Milwaukee, Wis
Blakeslee Mfg. Co., Du Quoin, Ill.
Fred M. Prescott Steam Pump Co., Milwaukee Wis.
Hall Steam Pump Co., Pittsburg, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa.

PUNCHES—
E. Konigslow & Bro. Cleveland, O.

PYROMETERS—
Edward Brown, Philadelphia, Pa.
Vulcan Mfg. Co., Pittsburg, Pa.

RADIAL DRILLS—
Bickford Drill and Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass.
American Tool Works Co., Cincinnati, O.

RAILS—
L. K. Hirsch, Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.

RAILWAY SUPPLIES—
Cleveland City Forge & Iron Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.
L. K. Hirsch, Chicago, Ill.

RELAYING RAILS—
L. K. Hirsch, Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.

RIVETS—
Champion Rivet Co., Cleveland, O.
Jonse & Laughlins, Ltd., Pittsburg, Pa.

RIVETED STEEL PIPE—
The Wm. B. Pollock Co. Youngstown, O.

ROCK DRILLS—
Rand Drill Co., Chicago, Ill.
The Ingersoll-Sergeant Drill Co., New York.

ROLL FORGINGS—
Samuel Trethewey & Co., Pittsburg, Pa.

ROLLING MILL MACHINERY—
The United Boiler Co., Girard, O.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
F. R. Phillips' Sons Co., Philadelphia, Pa
Whiting Foundry Equipment Co., Harvey, Ill.
The Lloyd Booth Co., Youngstown, O.
Vulcan Foundry & Machine Co., New Castle, Pa.

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DIRECTORY

To the Iron and Steel Works of the United States for 1898.

PUBLISHED BY
THE AMERICAN IRON AND STEEL ASSOCIATION.

Thoroughly Revised. Price, Seven Dollars.

The American Iron and Steel Association has just completed a thorough revision of its Directory to the Iron and Steel Works of the United States, bringing down to April, 1898, a description of these works. It also contains a complete Directory to many leading industries which are large consumers of iron and steel. This edition, which is the fourteenth that has been issued, embraces more complete details of all the iron and steel works of the United States, and of industries which are large consumers of iron and steel, than any preceding edition. It retains all the old features of preceding editions and contains many new features.

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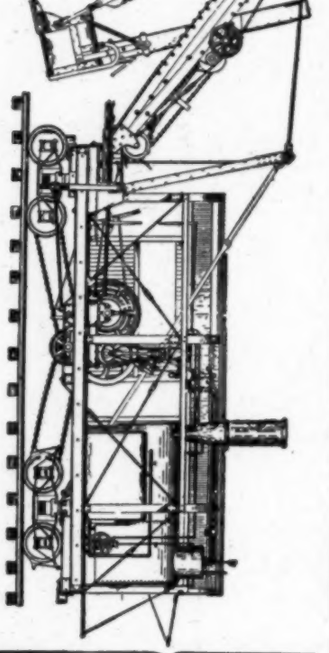

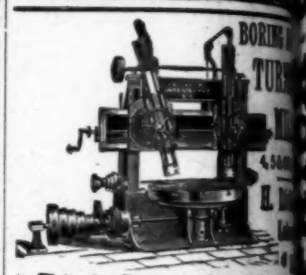

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